INRMP APPENDIX F- INTEGRATED WILDLAND FIRE MANAGEMENT PLAN

New Hampshire Department of Military Affairs & Veterans Services

New Hampshire Army National Guard

State Owned Properties, Center Strafford, Pembroke and Concord, NH

INTEGRATED WILDLAND FIRE MANAGEMENT PLAN

FOR

Department of Military Affairs & Veterans Services/
New Hampshire Army National Guard

New Hampshire National Guard Training Site,
Center Strafford, New Hampshire

Edward Cross Training Complex, Pembroke, New Hampshire
&
State Military Reservation, Concord, New Hampshire

PREPARED BY

Zachary Boyajian
Department of Military Affairs & Veterans Services
Wildland Fire Program Manager

John Neely
USDA Forest Service – White Mountain National Forest
South Zone Fire and Fuels

Arin Mills
Department of Military Affairs &
Veterans Services
Conservation Specialist

Approving Officials:

DAVID J. MIKOLATIES
Major General, New Hampshire National Guard
The Adjutant General

Date**:**_____

ZACHARY BOYAJIAN
Department of Military Affairs & Veterans Services
Wildland Fire Program Manager

Date:_____

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Chapter 1 - Introduction

1.1 Purpose

In accordance with Army Regulation (AR) 200-1 the New Hampshire Army National Guard (NHARNG) has written this Integrated Wildland Fire Management Plan (IWFMP) for the State Military Reservation (SMR) in the City of Concord, the Edward Cross Training Complex (ECTC) in the Town of Pembroke, and the New Hampshire National Guard Training Site (NHNGTS) in the Town of Center Strafford, NH, all located on state property under control of The Adjutant General of New Hampshire (TAG)/Department of Military Affairs & Veterans Services (DMAVS). This IWFMP is being incorporated into the Integrated Natural Resource Management (INRMP) for the sites as Appendix F. The IWFMP will develop goals, objectives and strategies for wildfire suppression, prescribed fire, and mechanical fuel reduction on all properties. This document will guide the fire management process on DMAVS/NHARNG lands. This IWFMP should be considered a 'living document' subject to change and revision as needed and is considered an integral part of the Integrated Natural Resources Management Plan.

The NHNGTS is located on the grounds of the former Austin Cates Academy on 104 acres of land. Austin Cates Academy closed in 1981 and the land and buildings were subsequently purchased by the state of New Hampshire for use by the National Guard in 1985. The NHNGTS provides classroom and field training to National Guard and other agency personnel. The NHNGTS contains a variety of habitats including grasslands, forests, and wetlands. Live fire and other types of field training occur here on a regular basis. Fire management activities on the NHNGTS will balance training needs with fire preparedness and fire prevention.

The ECTC is a 214 acre property purchased in 2009 for construction of a facility to house and operate the NH Regional Training Institute to provide classroom and field training exercises for National Guard personnel. The Edward Cross Training Complex as the facilities are call was constructed and became operation in 2017. A State Active Duty Annex and Readiness Center are planned to be constructed in the 2018-2020 time frame. The ECTC contains a variety of habitats including PPSOW and dry Appalachian oak forest (DAOF) as well as rare plants and animal species. The ECTC is open to the public and sees hiking, ATV, and hunting use. Fire management activities on the ECTC will balance training needs with natural resource and rare community conservation while reducing the impacts of a human caused fire.

In 2004, the NHARNG moved its Army Aviation Support Facility (AASF) from the SMR to a portion of the Concord Municipal Airport (CMA). The location of the new AASF site lay within pitch pine scrub-oak woodlands (PPSOW) identified as critical habitat for rare butterflies and natural communities. In order to develop this property the DMAVS/NHARNG agreed to offset the loss of PPSOW habitat on the airport by restoring and preserving on the nearby State Military Reservation. For the last 15 years, DMAVS/NHARNG staff have engaged in habitat restoration and monitoring

projects on the SMR in Concord. In a 15 acre area, grassland, shrub, and pitch pine habitat has been reclaimed successfully. Field surveys of the habitat indicate that it is approaching a point where prescribed fire is indicated as the best management strategy to perpetuate the PPSOW community. On other areas of the SMR, fuels reduction (mowing) is needed to maintain a buffer in the Wildland Urban Interface (WUI).

1.2 Legal and other Requirements

The DMAVS/NHARNG Integrated Wildland Fire Management Plan (IWFMP) has been written to address and comply with the following Department of the Army, and local, state and federal regulations and policies:

1.2.1 Army Regulations

AR 200-1 (Environmental Protection and Enhancement) dated 13 December 2007. Chapter 4-3 Land Resources paragraph (12) Wildland fire management includes:

(a) Reduce wildfire potential using appropriate management practices such as prescribed burning, firebreak maintenance/construction, etc.

(b) Installations with unimproved grounds that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool will develop and implement an integrated wildland fire management plan (IWFMP) that is compliant and integral with the INRMP, the installations' existing fire and emergency services program plan(s), and the Integrated Cultural Resources Management Plan (ICRMP).

(c) Assure that all civilian, contractor, and emergency services personnel involved in wildland fire management possess the level of training and physical fitness needed for their expected level of involvement.

(d) Ensure that only qualified personnel conduct prescribed burns.

AR 420-1 (Army Facilities Management) Dated 28 March 2009.

Chapter 25 Fire and Emergency Services Section X provides Army requirements for emergency response services for wildland fires. It requires the Garrison Commander (for the ARNG TAG) to appoint a Wildland Fire Program Manager and develop and implement an Integrated Wildland Fire Management Plan in accordance with Army Wildland Fire Policy Guidance.

32 CFR 651 (Environmental Analysis of Army Actions) dated March 29, 2002.

This regulation provides policies, procedures, and responsibilities for integrating environmental considerations into Army planning and decision-making. It outlines National Environmental Policy Act (NEPA) compliance requirements of proposed Army actions. This Regulation prescribes what army actions may be categorically excluded, or require preparation of an Environmental Assessment (EA) or Environmental Impact Statement. Development of INRMP normally requires an EA be developed and as such

an EA is being prepared that covers the INRMP and this IWFMP incorporated in the INRMP as Appendix F.

Army Wildland Fire Policy Guidance Memorandum (4 September 2002).

This guidance requires that all "installations with unimproved grounds that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool will develop and implement IWFMP that is integrated with the Integrated Natural Resource Management Plan (INRMP), the installation's existing fire and emergency service program plan(s), and the Integrated Cultural Resource Management Plan (ICRMP)." The purpose of the IWFMP is to reduce wildfire potential, effectively protect and enhance valuable natural resources, integrate applicable state and local permit and reporting requirements, and implement ecosystem management goals and objectives on Army installations. The policy requires that the IWFMP be reviewed and updated annually and revised at least once every 5 years. The guidance outlines 15 components of IWFMPs and describes program authority for fire management. The guidance also includes certification, training, and fitness standards for wildland fire management personnel. The NHARNG IWFMP uses the guidance and format presented in the Army Wildland Fire Policy Guidance (04 September 2002), with exceptions as needed to meet DMAVS/NHARNG specific conditions.

1.2.2 Federal Regulations:

- The Federal Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884)
- The National Historic Preservation Act Section 106 (16 U.S.C. 470f)
- The Federal Clean Water Act of 1972 (33 U.S.C. §1251 et seq.)
- The Federal Clean Air Act of 1963

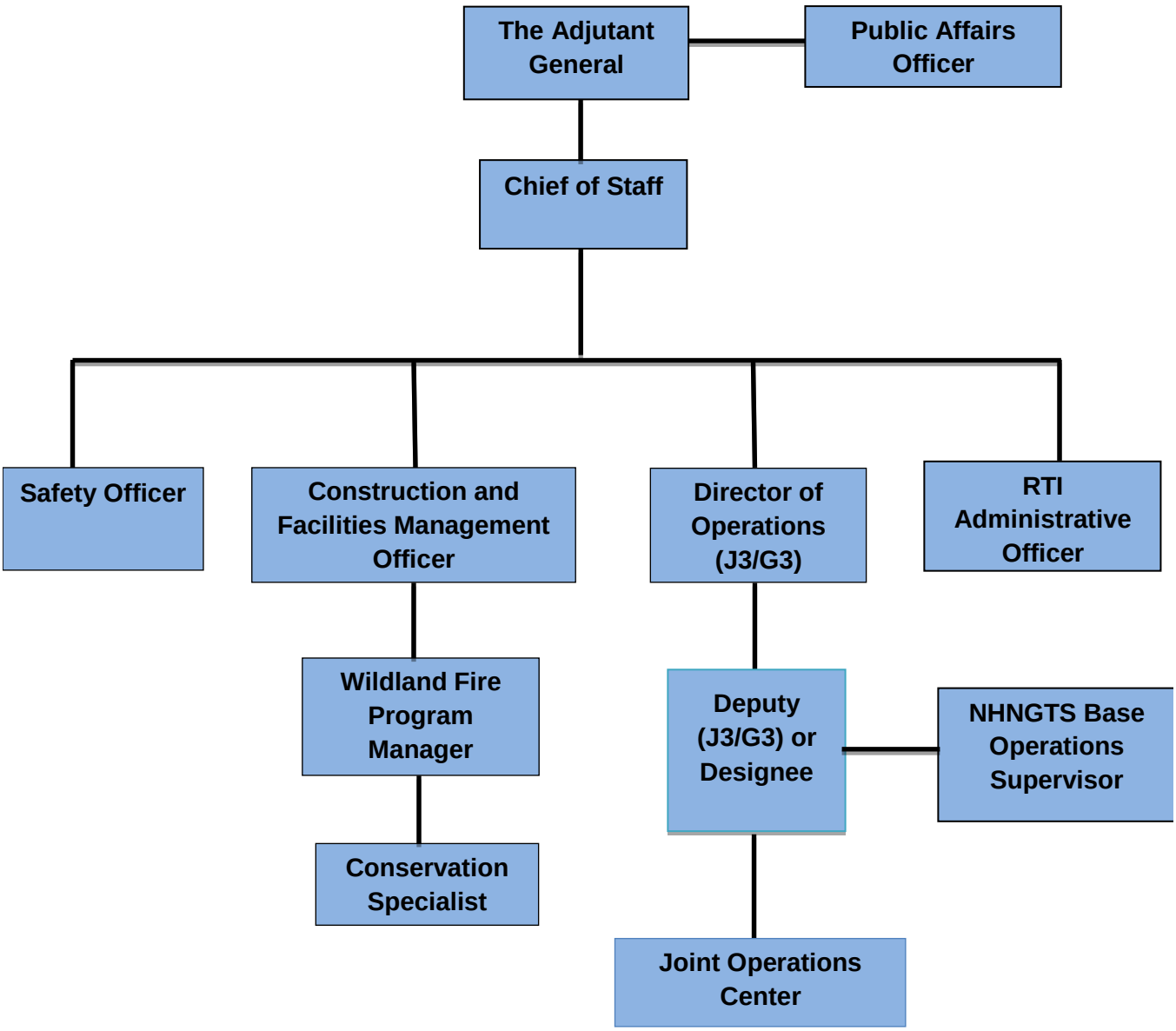
1.2.3 State Regulations

- NH Department of Environmental Services (NHDES) Administrative Rule Env-1000 and Env-A 1001.5
- Prevention Abatement and Control of Open Source Air Pollution
- NHDES Env-Dw 901 Ground Water Reclassification
- NHDES Env-Wq 401 Best Management Practices for protection of Ground Water
- NH Revised Statutes Annotated (RSA) Chapter 212-A Endangered Species Conservation
- NH Revised Statutes Annotated (RSA) Chapter 227-L Woodland Fire Control/Burn Permit Requirements
- NH Res 5600 Forest Fire Service Rules
- NH Native Plant Protection Act (RSA 217-A)
- the NH Shoreland Water Quality Protection Act (RSA 483-B) Rules Env-Wq 1400 Shoreland Protection

1.3 Organizational Structure and Responsibilities

The NH Army National Guard includes both federal and state employees all operating under the control of The Adjutant General and operating on State Land.

Figure 1 NHARNG Wildland Fire Organization Chart



The Adjutant General (TAG) has overall responsibility for the military installation covered by this IWFMP and approves the IWFMP. TAG designates the installation Wildland Fire Program Manager. TAG also approves the deployment of Army civilian firefighters to any off installation incidents.

The Public Affairs Officer (PAO), or appropriate designee, provides information to the local community, state and federal agencies, and general public of fire management activities that may cause impacts on and off DMAVS properties. The PAO is responsible for any outreach or responses to the media. The PAO will be responsible for being aware of the IWFMP and speaking with the public and/or other interested parties on behalf of the TAG in the event of a wildfire or other event.

The Chief of Staff (COS) is responsible for direct oversight of G Staff/Directorate level staff of the NH Army National Guard. They are responsible for ensuring coordination between G Staff/Directorates and meeting all mission and legal requirements for TAG.

The State Safety Officer (SSO) is responsible for ensuring the safety of all civilian and military personnel working on DMAVS properties. The SSO provides safety guidance to the wildland fire program and assists with safety related training if requested.

The Director of Operations (J3/G3) is responsible for oversight of training lands and operational responsibilities on the ECTC. The J3 also has responsibility for the JOC.

The Deputy (J3/G3) will relay information from the Joint Operation Center to the Director of Operations. The Deputy J3/G3 or designee will supervise the NHNGTS Base Operations Supervisor.

The Wildland Fire Program Manager (WFPM) plans, coordinates and implements all wildland fire management activities. The WFPM develops the IWFMP and reviews and approves prescribed burn plans to ensure consistency with IWFMP. The WFPM assures fire management activities are in accordance with Integrated Natural Resource Management Plans, site Conservation Plans; the installation Cultural Resource Management Plan; and DoD, federal, state, and local regulations applicable to fire management on DMAVS properties. The WFPM coordinates with state and local agencies and local Fire Departments to ensure that fire management is conducted in accordance with state and federal regulations. The WFPM assures the maintenance of wildland fire fighter training records for DMAVS and signs state fire permits as the land owner’s agent.

The Construction and Facilities Management Officer (CFMO) is responsible for Fire and Emergency services including wildland fire suppression and structure protection. The CFMO is responsible for the Sustainable Range Program and the Integrated

Training Area Management Program (ITAM). The CFMO is responsible for oversight of the NHARNG Environmental Program including the Wildland Fire Program.

NHNGTS Base Operation Supervisor (BOS) is responsible for coordinating activities on the NHNGTS training lands. BOS coordinates with WFPM to integrate military training and wildland fire management projects. BOS may act as military liaison to State and local firefighters if additional support is needed. SMs assists in development of the IWFMP and ensure consistency of all wildland fire activities with the range activities and site uses. BOS coordinates training area and range safety for all site users including wildland firefighters, enforces fire restrictions and works with the WFPM and local Fire Departments to develop suitable alternatives to fire restrictions. BOS identify and value physical property in the training areas; monitors fire danger and modifies training as needed to reduce risk of wildfire.

RTI Administrative Officer (RTI AO) coordinates day to day activities of the 195th Training Regiment. The RTI AO coordinate use of training areas on the ECTC. The RTI AO is responsible for notifying JOC any wildland fires. The RTI AO may act as military liaisons to State and local firefighters if additional support is needed on the ECTC.

The Conservation Specialist is responsible for all natural resource management activities and coordinates with the WFPM and will act as the alternate WFPM. The Conservation Specialist assists the WFPM in planning and implementing projects to support the IWFMP. Maintains Wildland Fire Qualifications and participates in prescribed burning and suppression as necessary.

The Joint Operation Center (JOC) is responsible for notifying NH National Guard Command personnel and the WFPM in the event of a Wildland Fire.

Other entities not listed on the Organization Chart that have responsibilities for fire management include:

Site Personnel and Site Users- Responsible for contacting 911 upon discovery of a wildland fire and notifying the JOC though their chain of command (supervisor/commander). Site users will also notify the BOM.

Department of Natural and Cultural Resources (DNCR), Division of Forest and Lands, Forest Protection Bureau (FPB) – Responsible for coordinating extended attack and jointly issues fire permits with the local fire warden in Concord, Pembroke, and Center Strafford. Responsible for maintaining Incident Qualifications System (IQS) records for NHARNG personnel.

Town of Pembroke Fire Department - Responsible for Initial Attack on the ECTC. This department jointly issues fire permit with FPB for prescribed burning at the ECTC.

City of Concord Fire Department - Responsible for Initial Attack on the SMR. This department jointly issues fire permit with FPB for prescribed burning on SMR.

Town of Center Strafford Fire Department - Responsible for Initial Attack on the NHNGTS. This department jointly issues fire permit with FPB for prescribed burning on NHNGTS.

Capitol Area Mutual Aid- is responsible for providing additional fire suppression resources during initial and extended attack incidents on the ECTC and SMR.

Lakes Region Mutual Aid- is responsible for providing additional fire suppression resources during initial and extended attack incidents on the NHNGTS.

1.4 Military Mission

The NHNGTS is the primary location in the State of New Hampshire for NH Army National Guard training. The NHNGTS hosts classroom and field training for NHNG and cooperating agencies. Approximately 90 acres of land are used for a variety of field exercises including Military Operations on Urban Terrain (MOUT), land navigation, small arms training, 31 Meter Baffled Range and exercises involving pyrotechnic devices. 14 acres of developed land is used for classrooms and administrative space. The NHNGTS has a staff of approximately 15 and the capacity to train 50-200 people at a time. 15,000-18,000 soldiers and cooperators use the site annually.

Future plans to increase training opportunities at the NHNGTS include the following:

- Baffled 25m Rifle Range
- Live Fire Exercise Shoot House
- Land Navigation Course Extension
- Rappel Training Area
- Confidence Course
- Leadership Reaction Course (LRC)
- Forward Operating Base (FOB)
- Simulator Building

The State Military Reservation (SMR) serves as the headquarters for the New Hampshire National Guard and employs approximately 400 state and federal personnel. Activities conducted at the various shops located at the SMR include the maintenance and repair of tactical vehicles, field artillery equipment, and construction equipment. The JOC is located on the SMR and staffed 7:30am to 4:30 pm with a staff duty officer on call after hours. The NH Fish and Game Department maintains a Karner blue butterfly (KBB) rearing building on the SMR. Fire Management operations should not impact the SMR to a great extent. Most of the fuel types have been maintained by mowing and could continue to be mowed for fuel reduction and habitat conservation. In some areas, prescribed fire is a viable management strategy that fits into the SMR requirement of restoring/maintaining Pitch Pine-Scrub Oak Barrens habitat.

The ECTC includes a general purpose administrative building and barracks building along with parking lots and running track. A Readiness Center is planned for construction in federal fiscal year 2019. The ECTC includes 194 acres of semi-improved and unimproved lands available for limited field training. The ECTC is operated by the 195th Training Regiment/NH Regional Training Institute (RTI). The mission of the RTI is to provide motivating and professional education and individual doctrinal training to all students and provide local, cost effective, and high quality training to meet the needs of the whole Total Army School System (TASS). On order, the 195th Regiment will mobilize and deploy within the State of New Hampshire or elsewhere to support the Governor of New Hampshire and other local, state and federal agencies for Homeland Defense.

The ECTC will be used by the RTI for normal administrative office business five (5) days per week, with inactive duty training (IDT) twelve (12) weekends per year and for multiple training periods of two (2) weeks or more throughout the year for various courses. At peak utilization, it could potentially be used 48 out of 52 weekends and up to 10 weeks per year for training exercises. The NHARNG's RTI provides individual training and post-secondary education in general studies, combat arms, leadership, Military Occupational Specialty (MOS), Non-Commission Officer Education System (NCOES), Officer Candidate School (OCS), additional skill identifier (ASI) courses, and other subjects as needed. Courses are offered on a regional basis, with instruction available to soldiers throughout the New England region.

The ECTC consist of a General Instruction and Administrative Building which will accommodate a student load of 81 students and 35 staff/instructors, including 4 to 8 full-time personnel. In addition to the General Instruction and Administrative Building, the ECTC also includes a barracks building (approximately 48,537 sf) to include open bay billets, one and two person shared billets, and officer billets. The barracks have been designed to incorporate antiterrorism/force protection and utilize sustainable energy equipment and methods for increased efficiency. Supporting facilities include sidewalks, exterior fire protection, outside lighting and storm water bio-retention pond(s). A variety of physical security/anti-terrorism force protection measures have been incorporated into the design. Associated support structures include a quarter-mile rubberized running track to accommodate the administration of the Army Physical Fitness Test (APFT) to students.

The ECTC includes a paved privately owned vehicle (POV) parking area (4,640 square yards) adjacent to the ECTC General Instruction and Administrative Building. This parking area will include student, staff, and visitor parking, handicapped parking; and an access road (5,000 square yards). An additional military vehicle parking area (1,225 square yards) will be constructed adjacent to the ECTC General Instruction and Administrative Building, to include a military vehicle loading ramp (410 square yards), maintenance bay door aprons (187 square yards), a dumpster area and access to a

controlled waste facility. The new facility will provide adequate resources for training requirements as follows:

- Land navigation by foot, including orienteering, terrain association and basic and advanced compass work with sufficient relief and vegetation cover;
- Patrolling by foot and marching;
- Movement to contact activities;
- Ambushes (both hasty and deliberate types);
- Basic field craft (patrolling);
- Physical fitness training (Fitness tests, calisthenics and hand-to-hand combat);
- Tactical tasks; and
- HIMARS crew drills in preparation of firing (no HIMARS firing will take place).

All field training operations that will be conducted include a means of emergency rescue via the use of an ambulance or appropriate rescue vehicle, by which to safely evacuate injured students. (NHARNG 2009)

Prior to beginning field training operations, it will be necessary for the WFPM and BOS to coordinate training mission activities with fire management activities.

There are no plans to use pyrotechnic devices for training on the ECTC or SMR. The Wildland Fire Program Manager and SM will determine if training restrictions are necessary based on predicted class day and planned field training.

The Wildland Fire Program Manager and SM will determine if training restrictions are necessary based on predicted class day and planned field training.

1.5 Integration with other plans

This IWFMP is a component plan to the Integrated Natural Resource Management Plan for the New Hampshire National Guard, Concord Pembroke and Strafford, New Hampshire; the NHARNG ICRMP (as amended to include the ECTC), the known and planned activities on these lands, and the NHARNG Long Range Construction Plan. The IWFMP will be reviewed on an annual basis and integrated with these plans and other planning documents that are developed or modified in the future.

1.6 Programmatic Environmental Review

This IWFMP is being evaluated under National Environment Policy Act as part of the Environmental Assessment (EA) for the Integrated Natural Resources Management Plan for the New Hampshire National Guard Concord, Pembroke and Center Strafford, NH (2020). Additional evaluation of effects and environmental considerations will take place though annual review and coordination meetings and planning. Agency comments and responses to comment can be found in Appendices of the EA.

During the development stage of this plan and the previous Wildland Fire Management Plan (2014), meetings were held with the New Hampshire Fish and Game Department, New Hampshire Division of Forests and Lands, the New Hampshire Department of Environmental Services, and the Town of Pembroke Fire Department and Waterworks Department and the Town of Strafford Fire Department to discuss proposed fire management actions. Information on potential effects to cultural resources was provided to the New Hampshire Division of Historical Resources.

1.7 Annual Review and Coordination

The DMAVS/NHARNG will establish and maintain regular communications with the appropriate federal, state, local and installation organizations to address issues concerning implementation of this IWFMP. At a minimum, this includes an annual review of the IWFMP by DMAVS/NHARNG representatives in coordination with the U.S. Fish and Wildlife Service (USFWS), the New Hampshire Department of Fish and Game (NHF&G), the New Hampshire Division of Forest and Lands (NHDFS), the Concord, Pembroke and Strafford Fire Departments, and the Pembroke Waterworks. This annual review verifies that:

- Projects and activities for the upcoming year are consistent with goals and objectives of IWFMP and INRMP.
- All required coordination with the cooperating agencies has occurred, and
- Any significant changes to the installation's mission requirements, operating documents, or natural resources have been identified.

Chapter 2 - Existing Conditions

2.1 Location and History

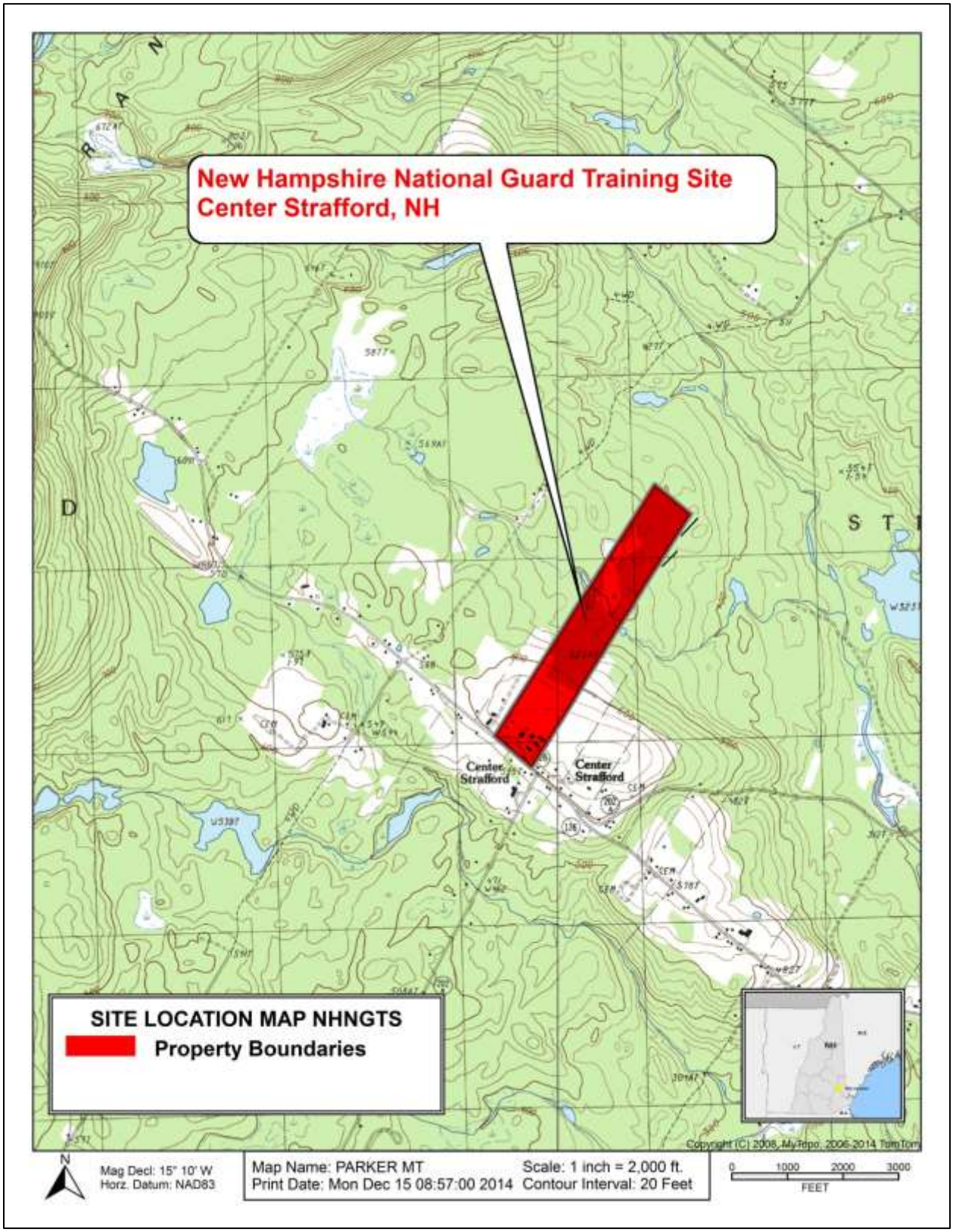
The NHNGTS is located in the Town of Strafford New Hampshire in the village area known as Center Strafford (MAP 1). Center Strafford is located 21 miles east of the state capitol the City of Concord, off of Parker Mountain Road/Route 126. The site is 104 acres of fields, forests and wetlands bounded by private land on all sides. Private land to the east and west includes houses and well maintained hay fields. Private land to the north is undeveloped forest. The center of town lies south of the property and includes agricultural land, an elementary school, a church, private residences and the Center Strafford Fire Station. DMAVS purchased the NHNGTS in 1985. More detail can be found in the INRMP.

The ECTC is situated approximately three miles southeast of Concord, New Hampshire, off Riverwood Drive in Pembroke, NH (Map 2). The site is a 214 acre property bounded on the north and west by the Soucook River, with the Concord Municipal Airport lying north and west of the river. South of the site are vacant undeveloped land, commercial businesses and the public water supply wells of the Town of Pembroke, operated and maintained by the Pembroke Water Works. Several commercial and light industrial properties lie east of the site.

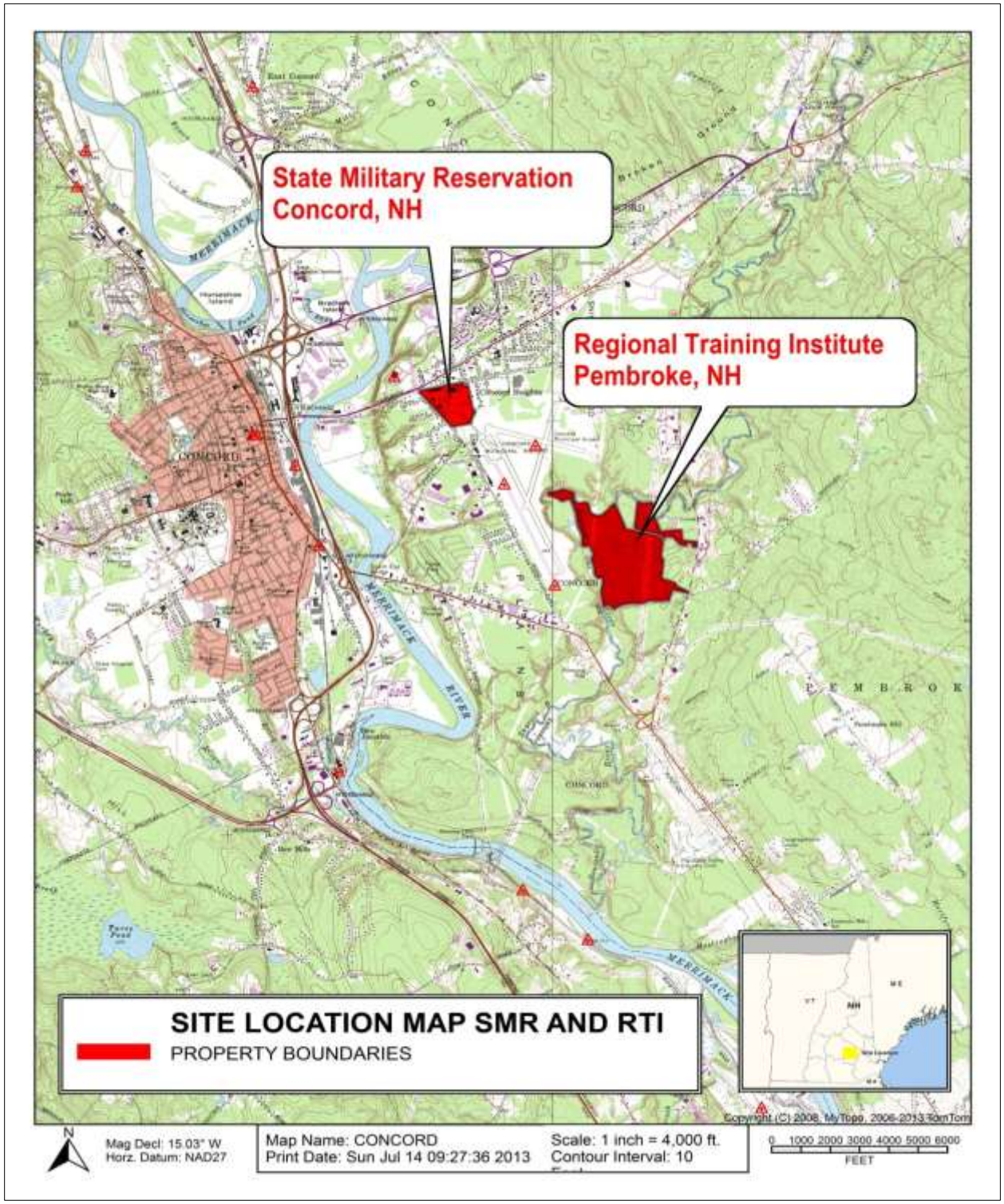
The SMR is located in City of Concord, NH (Map 2). The 45 acre property is bounded by roads and urban development in an area of East Concord known as the Concord Heights. The SMR is bordered by residential, commercial and industrial development, which includes the Concord Municipal Airport. SMR has been used by the NHNG since at least the 1880 when the Concord Arsenal (Building B) was construction on land then being leased from the City of Concord.

Both the SMR and ECTC properties are located in what historically was a large pitch pine-scrub oak natural community known as the Concord Pine Barrens macrosite. At one time this community encompassed 4,500 acres in eastern Concord and Pembroke. This area was subject to frequent wildfires and contained fire dependent plant and animal species. Currently the community is fragmented, estimated at 500 acres and is considered to be globally threatened. The Concord Pine Barrens contains the largest assemblage of state and federally listed rare moths and butterflies in the state, including the federally endangered Karner blue butterfly (KBB).

Map 1 Location of New Hampshire National Guard Training Site, Strafford, NH



Map 2 Location of ECTC and State Military Reservation, Concord



2.2 Surrounding Communities Wildland Urban Interface

The Wildland Urban Interface (WUI) is commonly defined as the area where human developments and naturally occurring vegetation mix. Under this definition, all NHARNG properties analyzed in this plan are located within the WUI (See Map 3, Map 4 and Map 5).

Map 3 NHNGTS Wildland Urban Interface Zone

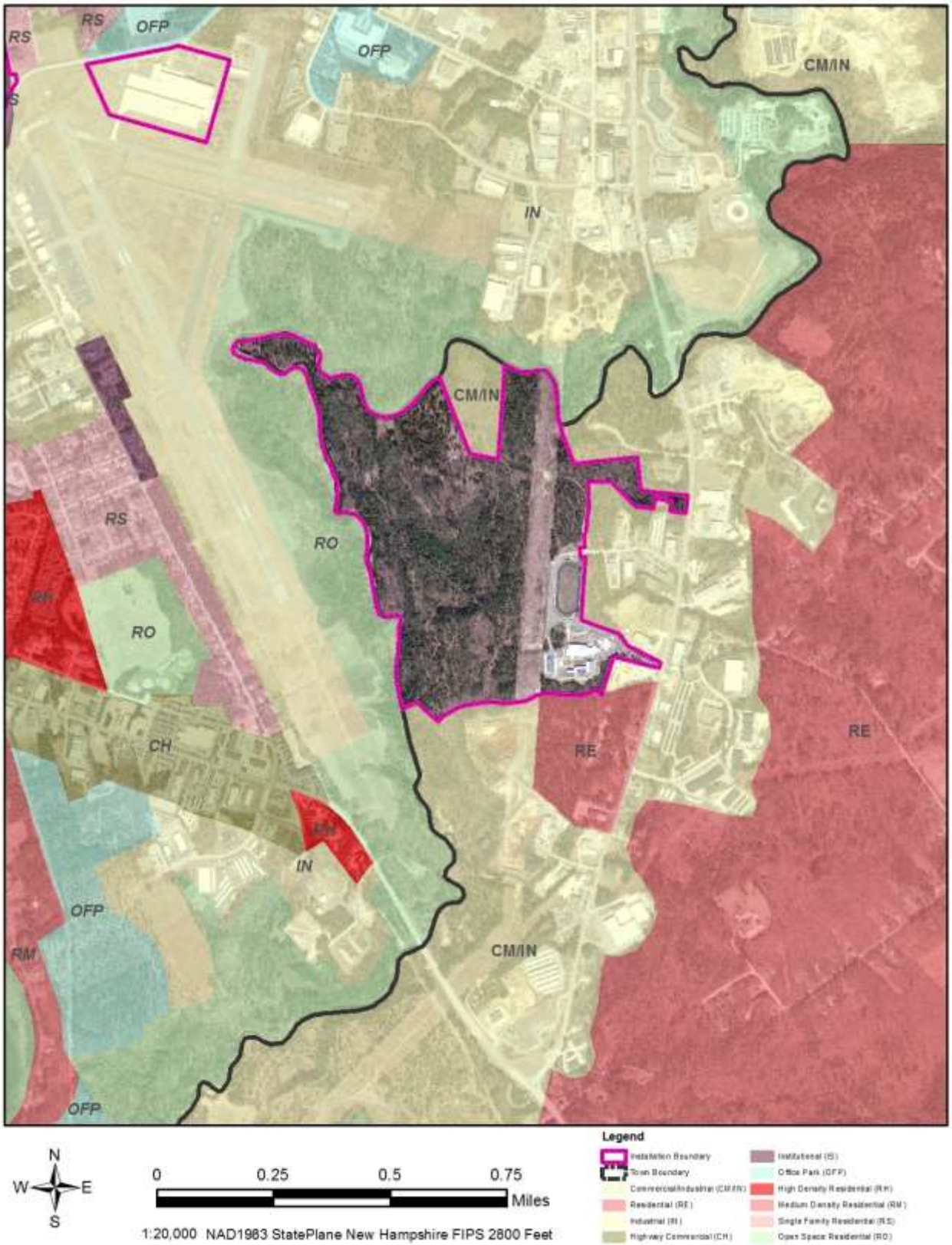
The NHNGTS is located in the village of Center Strafford. The mixture of structures and vegetation is rural in character. Adjacent to the NHNGTS along Parker Mountain road are scattered farms and houses, the Strafford school, churches and town offices, and the volunteer fire station. The vegetation consists mostly of well-maintained hay fields and pasture that will be resistant to fire most times of the year. The northern section of the NHNGTS is forested as is the adjacent private land. There are no homes or other structures adjacent to the NHNGTS to the north.

The ECTC is located west of Route 106 in a mostly commercial and industrial area of the Town of Pembroke. There is also some residential land use along Route 106 and more concentrated residential land use east of Route 106. The CMA is directly north and west of the ECTC. An Eversource power line right-of-way and National Grid buried natural gas line right-of-way bisect the ECTC.

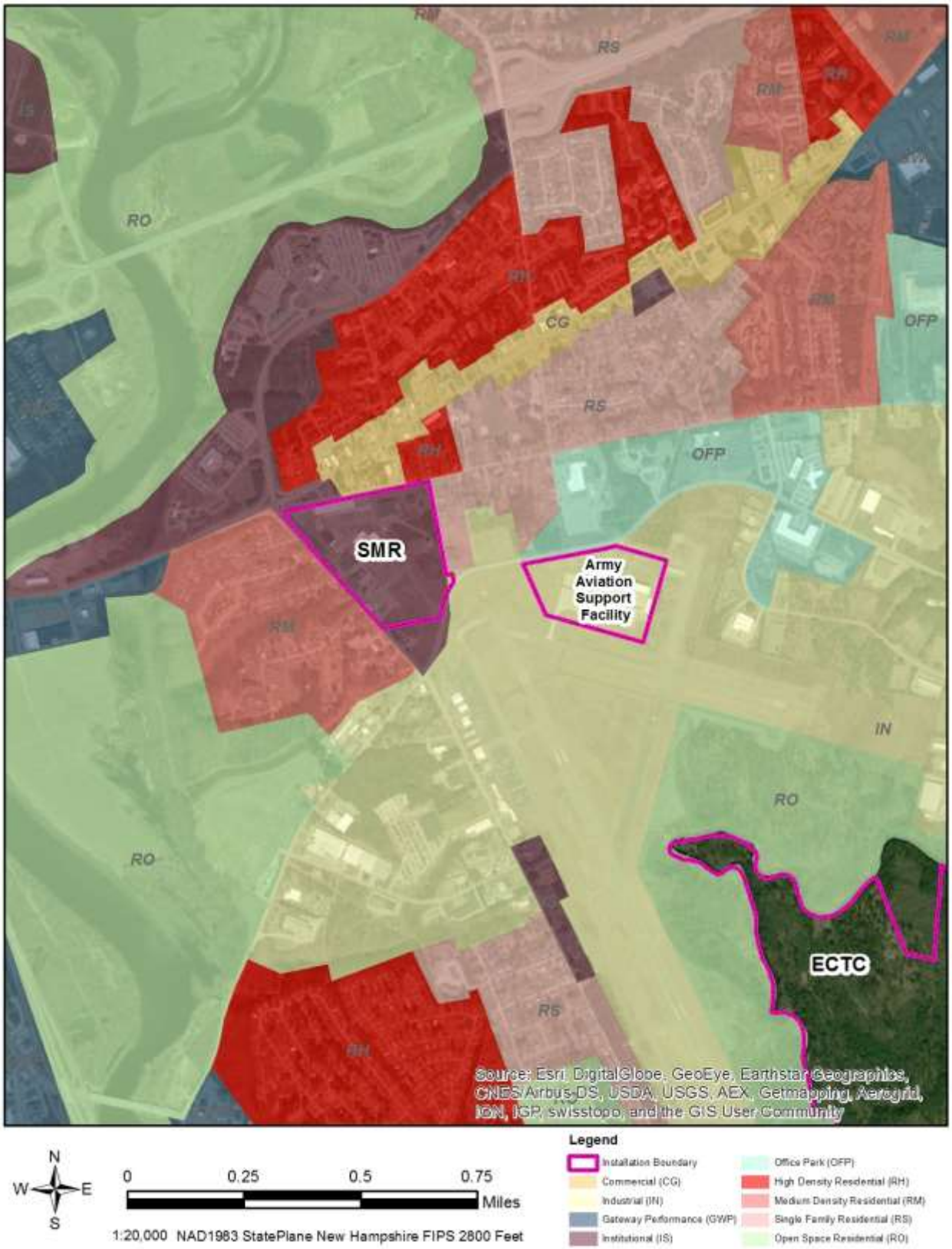
The SMR is located in the Concord Heights District, a busy section of the city containing a high concentration of businesses and residences. Several schools are nearby. Pembroke Road, Airport Road and Regional Drive are primary roads adjacent to the SMR. The Concord Municipal Airport (CMA) is directly south of the SMR. The NHF&G uses prescribed fire and mechanical treatment to maintain pine barrens habitat on the CMA.

Pitch Pine-Scrub Oak Woodlands (PPSOW) which exists on both the SMR and ECTC are considered to be the most fire dependent and volatile in the northeastern US. The close proximity of DMAVS/NHARNG lands to communities and infrastructure increase the need to manage fuel loads and reduce potential for wildfires.

Map 4 ECTC Wildland Urban Interface Zone



Map 5 SMR Wildland Urban Interface Zone



2.3 Vegetation

NHNGTS

The NHNGTS property contains approximately 51 acres of Hemlock Beech-Oak-Pine forest, 21.2 acres of grassland, 13.4 acres of marshland, and 2.4 acres of shrub/hedgerow. 16.8 acres is classified as non-burnable developed areas. Canopy thinning is planned in a portion of the site to improve habitat for the small whorled pogonia. There are no specific plans for timber harvestings. There are no fire dependent or fire adapted natural communities on the NHNGTS. Prescribed fire is planned to maintain the grasslands to benefit wildlife and facilitate training.

ECTC

The ECTC contains approximately 15 acres of PPSOW habitat, 145 acres of DAOF habitat, 20 acres of disturbed grassland/shrubland in the power line right of way, 10 acres of red maple swamp, 15 acres of floodplain habitat and 2.5 acres of hemlock/white pine habitat. A past history of forest management is evident, especially in the Dry Appalachian Oak Forest (DAOF). Mechanical treatment of fuels during fall of 2015 in Management units PPSOW3, PPSOW4, PPSOW8 and portions of PPSOW1, PPSOW7, and PPSOW9 along with some firebreak improvement to support prescribe fire was conducted and using a brontosaurus. Forestry operation in the winter of 2016-2017 in management PPSOW8, PPSOW10, PPSOW11 and portions of PPSOW7 and PPSOW9 reduced canopy shrub cover to set back succession, release suppressed scrub oak and prepare for prescribe fire to restore PPSOW. The INRMP identifies goals of maintaining and restoring PPSOW that were known to exist in the early 1990's and maintaining DAOF using prescribed fire as a primary mechanism for ecosystem management.

Nine natural communities were identified by the NH Natural Heritage Bureau during field surveys (see Table 1 and Figure 21 contained in the INRMP). Based on short fire return intervals in PPSOW and medium length fire return intervals in Dry Appalachian Oak Forest (DAOF) the DMAVS/NHARNG plans to use prescribed fire as an ecosystem management technique. The other natural communities either have long fire return intervals indicative of system that are not well fire adapted or are not expected to have fire as a natural disturbance mechanism. The DMAVS/NHARNG does not intend to use prescribe fire in these system.

Table 1 ECTC Natural Community

Natural Community Name	State Rank	Landfire RAFC model	Fire Regime Group	Fire Return Interval	Fuel Model
Pitch pine - scrub oak woodland (Merrimack Valley variant)	S1/S2	Pine Barrens	1	20-40 years for woodlands, 3-20 years for grass and shrub components	SH3, SH4, and SH8
Dry Appalachian oak forest	S3	Appalachian Dry-Mesic Oak Forest	1	100-200 years	TU2/TL6
Hemlock - white pine forest	S4	White Pine-Northern Hardwoods	5	300 years	TL3
Red maple - Sphagnum basin swamp	S4	Not applicable	5	400 years	TL2
Red maple floodplain forest	S2/S3	Not applicable	5	400 years	TL2
Herbaceous riverbank/floodplain	S4	Not applicable	Not applicable	Not applicable	Not applicable
Alder - dogwood - arrowwood alluvial thicket	S4	Not applicable	Not applicable	Not applicable	Not applicable
Cobble - sand river channel/ Mesic herbaceous river channel	S3/S4	Not applicable	Not applicable	Not applicable	Not applicable
Temperate minor river floodplain system	S4	Not applicable	Not applicable	Not applicable	Not applicable

State Military Reservation

Vegetation on the SMR consists of grasses, shrubs and small stands of trees primarily pitch pines located within a 15 acre habitat restoration area. The majority of the burnable wildland fuels are located on the eastern and southern portions of the SMR. The western side of the SMR contains mostly structures and parking lots. The fuels and natural community types on the SMR are a result of habitat restoration projects done to satisfy NEPA and Endangered Species Act (ESA) requirements for NHARNG to offset

land developed for construction of the AASF on the CMA. As such, the natural vegetation community on the SMR is specifically managed to satisfy the requirements associated with the *Final Environmental Assessment For Replacement of the New Hampshire Army National Guard Army Aviation Support Facility Concord, New Hampshire Dec 2000* which states- "*Replace the loss of PPSOB natural community vegetation by permanently protecting and restoring approximately 15.2 acres of land on the SMR by prohibiting additional development, removing existing facilities and restoring PPSOB vegetation."* Vegetation on the SMR will be managed to restore and sustain PPSOW vegetation and wild lupine to support recovery of the Karner blue butterfly using prescribed fire without additional impact to mission capabilities of the SMR.

2.4 Fuel Factors

NHNGTS

Fuels on the NHNGTS are a result of natural succession and resource management by NHNGTS staff. At least 2 wildfire have resulted from training activities on the site in the last 23 years. Use of pyrotechnics in portions of the NHNGTS make future wildfires a possibility. Fire behavior in the forested section will be characterized by surface fires with limited single tree torching. The combat trail provides an excellent firebreak and anchor point in the northern section of the training Site. The farthest point from the combat trail to the NHNGTS boundary is only 500'. The northern section also has a large wetland area that will act as a fire barrier and water source.

The southern section of the NHNGTS is well maintained grassland that will be resistant to fire most times of the year. A series of gravel roads subsect the grasslands and can be used as fire control lines.

Photo 1 NHNGTS Forested Habitat

Photo 2 NHNGTS Grassland Example

Photo 3 NHNGTS Johnsonboro Road Firebreak

ECTC

Fuel types at ECTC are a result of natural succession, resource management and wildfire. Although no wildfires have been recorded on the ECTC in the last 30 years several factors exist that raise the potential for occurrence. One is a growing homeless population that camps out on the property. Another is camping/party spots along the Soucook River. A third source of ignitions occurs along the power line Rights-of-way (ROW) used by all-terrain vehicles (ATV). The area was subject to deliberate arson fires in the late 1980's and early 1990's (H. Paulsen). The lack of regular disturbance in the wildland fuels has allowed them to reach a level that will support a wildfire during typical fire season conditions (Photo 4 fuel load examples on ECTC).

Photo 4 Fire excluded PPSOW community on Pembroke

Photo 5 Shrub/grassland fuels along power line corridor in Pembroke

SMR

The SMR property fuel types are a result of efforts by DMAVS/NHARNG staff to reclaim former grassland and pitch pine barrens. The result has been largely successful and some of the reclamation sites have reached a point where sufficient fuel exists to support a low to moderate intensity wildfire. Monitoring photos clearly show an increase in vegetation over a 9 year period (Photo 6). The wildland fuels on the SMR total 15 acres and will be managed through a combination of mowing and prescribed fire. Wildland fuels outside the SMR property boundary are fragmented and mostly consist of grasses and pine over story intermixed with residential neighborhoods. The potential does exist for a wildland fire to ignite on private land and move onto the SMR, especially to the south and east of the SMR.

Photo 6 Change in SMR fuel loads 2003-2012

SMR fuels 2003 photo by Zachary Boyajian

SMR fuels 2012 photo by Arin Mills

2.5 Fuel Types

Fuel models are used to estimate fire behavior. Scott and Burgan (2005) “Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel’s Surface Fire Spread Model” is being used by the DMAVS/NHARNG to estimate fire behavior for fire planning purposes.

These models are a standard used to estimate fire behavior and are loaded into most fire behavior software including BEHAVE 5+. Custom fuel models could also be created for DMAVS/NHARNG lands if needed.

NHNGTS

Scott and Burgen fuel models that best typify conditions on the NHNGTS are:

Fuel Model GR1- Short, Sparse Dry Climate Grass. The primary carrier of fire in GR1 is sparse grass, though small amounts of fine dead fuel may be present. The grass in GR1 is generally short, either naturally or by grazing/mowing and may be sparse or discontinuous. The moisture of extinction of GR1 is indicative of a dry climate fuelbed, but GR1 may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compared to other GR models. This fuel model may be used if grasslands on the NHNGTS have been mowed prior to burning.

Fuel Model GR3 – Low Load, Very Coarse, Humid Climate Grass. The primary carrier in GR3 is continuous, coarse, humid-climate grass. Grass and herb fuel load is relatively light; fuelbed depth is about 2 feet. Shrubs are not present in significant quantity to affect fire behavior.

Fuel Model TL6- Moderate Load Broadleaf Litter. The primary carrier of fire in TL6 is moderate load broadleaf litter, less compact than TL2. Spread rate is moderate; flame length low.

Fuel Model TL2- Low Load Broadleaf Litter. The primary carrier of fire in TL2 is broadleaf (hardwood) litter. Spread rate is very low; flame length very low.

Pembroke

Scott and Burgen fuel models that best typify conditions on the ECTCare:

Fuel Model SH3 – Moderate Load, Humid Climate Shrub. The primary carrier of fire in SH3 is woody shrubs and shrub litter. Moderate shrub load, possibly with pine overstory or herbaceous fuel, fuel bed depth 2 to 3 feet. Spread rate is low; flame length low.

Fuel Model SH4- Low Load, Humid Climate Timber-Shrub. The primary carrier of fire in SH4 is woody shrubs and shrub litter. Low to moderate shrub and litter load, possibly with pine overstory, fuel bed depth about 3 feet. Spread rate is high; flame length moderate.

Fuel Model TU2- Moderate Load, Humid Climate Timber-Shrub. The primary carrier of fire in TU2 is moderate litter load with shrub component. High extinction moisture. Spread rate is moderate; flame length low.

Fuel Model GS3- Moderate Load, Humid Climate Grass-Shrub. The primary carrier of fire in GS3 is grass and shrubs combined. Moderate grass/shrub load, average grass/shrub depth less than 2 feet. Spread rate is high; flame length moderate. Moisture of extinction is high.

Fuel Model TL2- Low Load Broadleaf Litter. The primary carrier of fire in TL2 is broadleaf (hardwood) litter. Spread rate is very low; flame length very low.

Fuel Model TL6- Moderate Load Broadleaf Litter. The primary carrier of fire in TL6 is moderate load broadleaf litter, less compact than TL2. Spread rate is moderate; flame length low.

Fuel Model SB1- Low Load Activity Fuel. The primary carrier of fire in SB1 is light dead and down activity fuel. Fine fuel Load is 10 to 20 t/ac, weighted towards fuels 1 to 3 inches diameter class, depth is less than 1 foot, Spread is moderate; flame length low.

Fuel Model SB2- Moderate Load Activity Fuel or Low Load blowdown. The primary carrier of fire in SB2 is moderate dead and down activity fuel or light blowdown. Fine fuel load is 7 to 12 t/ac, evenly distributed across 0 to 0.25, 0.25 to 1, and 1 to 3 inch diameter class, depth is less than 1 foot, Spread is moderate; flame length moderate.

SMR

Scott and Burgen fuel models that best typify conditions on the SMR are:

Fuel Model GR3 – Low Load, Very Coarse, Humid Climate Grass. The primary carrier in GR3 is continuous, coarse, humid-climate grass. Grass and herb fuel load is relatively light; fuelbed depth is about 2 feet. Shrubs are not present in significant quantity to affect fire behavior.

Fuel Model SH3 – Moderate Load, Humid Climate Shrub. The primary carrier of fire in SH3 is woody shrubs and shrub litter. Moderate shrub load, possibly with pine overstory or herbaceous fuel, fuel bed depth 2 to 3 feet. Spread rate is low; flame length low.

2.6 Fire History

NHNGTS

Significant wildland fire history does not exist at the NHNGTS. There are 2 know wildfires that have resulted from pyrotechnic use during training during the past 20-25 years. These fires ranges from <1 acres to about 3 acres in size.

ECTC and SMR

Although in recent history large wildfires in the Concord area have become uncommon events, at one time they were frequent and burned relatively large sections of land. The majority of these fires were located in and around what is known as the Concord Plains or Concord Heights, which contained the majority of the pitch pine scrub oak community and the DMAVS/NHARNG facilities and lands. A number of these fires jumped the Soucook River into the Town of Pembroke.

Historically, both Native Americans and European settlers deliberately set fires to improve hunting and berry picking, clear land for crops, and maintain travel routes. Later, fires were ignited by locomotives and other industrial sources. Up until about 100 years ago these fires were not suppressed, areas like the Concord Plains were lightly settled and used mostly for hunting and timber harvest. Gradually however, the Concord Plains was settled and suppression of fires became a priority. Table 2 shows the changes that have occurred over the last 100 years in the fire history of Concord and Pembroke as researched by John Neely of the White Mountain National Forest.

The Concord Pine Barrens: Fire and Landscape History by Akers (1994), a report submitted to The Nature Conservancy also detailed a wildfire chronology that included a number of fires not identified by Neely including multiple fires in 1869, 1890’s, 1963,1980, and multiple fires in May of 1981.

Table 2 Wildfire History Concord and Pembroke

YEAR	MONTH	LOCATION	ACRES BURNED
1909-1910	Unknown	Concord	1,364
1910-1911	Unknown	Concord	3,316
1912-1913	Unknown	Concord	1,631
1915-1916	Unknown	Concord	1,280
1921-1922	Unknown	Concord	1,489
1928	May	Concord Plains	1,100
1947	Unknown	Fires burning statewide including Concord	Unknown
1955	May 16	Concord Heights	50
1957	May 9	Pembroke, adjacent to ECTC	806
1962	April 23	Concord Plains, off Loudon Road	30
1962	April 26	Concord Plains, near Sheep Davis and Old Loudon roads (possibly part of NHARNG ECTC involved)	300
1965	April	Concord Heights (approx. 1 mile from NHARNG)	Unknown
1968	March 28	2 large grass fires near Pembroke Road and Manchester Street (approx. 2500’ south of ECTC boundary)	Unknown
1972	May 1	Concord Heights	30
1985	April	Multiple brush fires in Concord including one near Garvin’s Falls and 90 acres in Concord Heights in same area as 1965 fire (Photo 7and Photo 8)	90
1986	May 15	Garvin’s Falls Rd., Pembroke	50
1985-1990	Unknown	Several small fires on what is now the ECTC. Including campfire near Soucook River, an arson fire and an ATV caused fire along powerline corridor	Unknown
2007	May 9	71 Airport Rd. Concord	13

Photo 7 Wildfire April, 1985 Concord Heights

Photo 8 Wildfire April, 1985 Concord Heights

Photos courtesy of Neil Bilodeau, NH Forest and Lands

2.7 Climate/Weather

The climate of southern New Hampshire is characterized by warm, humid summers and cold snowy winters. Average monthly precipitation is 3.0" with the highest amounts falling in spring-early summer and late fall. Average annual temperature in Concord and Pembroke is 46.4 degrees F, average in Center Strafford is 44.9. The highest average temperature (70F) occurs in July and the lowest average (20.6F) occurs in January. Southern NH is usually snow free from May to September with a growing season of approximately 102 days.

Winds are predominantly out of the northwest (21%), west (11%) and south (11%). Wind speeds average 8 mph annually.

New Hampshire experiences mild drought conditions on average every 27 months. The last severe droughts occurred in 2001-2002 and 2016.

Weather factors can vary greatly; a low humidity, high wind or high temperature appears to be a factor contributing to growth of a fire. For the most part, fires are burning in the DMAVS/NHARNG area without the typical conditions of combined high temperature, low humidity and high winds being present. The following table tracks the weather associated with fires from Table 2 that have a month and date:

Table 3 Known Fire Weather Data

Year	Date	Location	Acres Burned	Temp Degrees F	Relative Humidity	Wind Speed and Direction
1955	May 16	Concord Heights	50	Max 79 Av 60	Min 28 Av 62	Av 4 mph WNW Max 20 mph
1957	May 9	Pembroke	806	Max 87 Av 67	Min 22 Av 43	Av 6 mph WSW Max 20 mph
1962	April 23	Concord Plains	30	Max 69 Av 55	Min 39 Av 53	Av 9 mph W Max 21 mph
1962	April 26	Concord Plains	300	Max 66 Av 52	Min 32 Av 62	Av 7 mph SSE Max 20
1968	March 28	Concord/ Pembroke Town line	Unknown	Max 55 Av 42	Min 37 Av 66	Av 3 mph SE Max 12 mph
1972	May 1	Concord Heights	30	Max 77 Av 61	Min 26 Av 51	Av 6 mph N Max 8 mph
1986	May 15	Pembroke	50	Max 73 Av 54	Min 27 Av 60	Av 4 mph SE Max 14 mph
2007	May 9	Concord	13	Max 90 Av 69	Min 18 Av 48	Av 4 SSW Max 16-20 mph

For more information on Concord climate and weather go to:
http://www.erh.noaa.gov/er/gyx/climate_f6.shtml

FireFamilyPlus weather and fuels data from the Bear Brook weather station is compiled in Appendix B.

2.8 Natural and Cultural Resource Considerations

Information on natural resource at the the NHNGTS, ECTC and SMR is available in the appropriate sections of the Integrated Natural Resources Management Plan For The New Hampshire National Guard, Concord, Pembroke and Strafford, New Hampshire as follows:

Chapter 4 Physical Environment

4.1 Climate

4.2 Land Forms

4.3 Geology and Soils

4.4 Soils

Chapter 5 Ecosystems and the Biotic Environment

5.1 Ecosystem classification

5.2 Vegetation

5.3 Fish and Wildlife

5.4 Rare, Threatened and Endangered Species

5.5 Water Resources

5.6 Other Natural Resource Information (Cultural Resources)

7.13 Cultural Resources.

Natural and cultural resource and consideration specific to Wildland Fire Management are further developed for each of the sites.

NHNGTS

Table 4 NHNGTS Fire Management Rare Species Conservation Measures

Species	Conservation Measures
Small-whorled pogonia	Prescribed fire is not planned in small-whorled pogonia habitat Establish shaded fire breaks with machinery during frozen conditions or with hand crew August 1st to May 31st.
Birds	Conduct prescribed burns in grassland units and establish shaded firebreaks August 15th to April 30th outside the nesting season.
Turtle and snakes,	Survey burn unit prior to ignition, brief & instruct burn crew to report any sightings to burn boss, use ignition patterns that reduce chances of wildlife entrapment (e.g. Backing fire, spot ignition, flanking and inverted chevron), remove any individuals encountered outside burn unit.
Bats	Established shaded fire break August 1st to May 31st outside of pupping season.
Insects	Conduct prescribed burns late or early season.

Water Resources

A portion of the NHNGTS is within the wellhead protection area for the Strafford Central School drinking water system (See Figure 18 in the INRMP). Sanitary protective areas are also esablished within a 200 foot radius of the drinking water wells on the NHNGTS. Wildland fire management activities including prescribed burning are not expected to take place within either of these two protective zones.

Cultural Resources

Archaeolgical surveys of the NHNGTS were conducted in 1999, 2001, 2003, 2012, 2013-2014, 2016, 2017 and 2018. 2 archaeological site exists on the property. Fire management activities are not planned immediately adjacent to the sites. Numerous historic stone walls exist on the property and allong the property boundaries. Care will be taken during establishment of shaded fuel breaks to avoid altering any of these stone walls. Consulation with the NHARNG Cultural Resourse Manager will be conducted as needs arise. Additional detail are available in INRMP section 7.13.

ECTC Natural Resource Considerations

There are a number of rare threatened and endangered species on the ECTC. A number of conservation measure/management practices will be employed to minimize effect to those species. While the KBB is currently not expected to be affected by fire management activities, should wild lupine repopulate other locations on the ECTC such as PPSOW management unit protection strategies for the Lepidoptera in Table 5 will be employed.

The ECTC was surveyed for archaeological resources in 2007 during analysis for the ECTC acquisition process. Intensive surveys were done in and around the proposed construction site. Further archaeological surveys were conducted in 2011, 2012, 2013, and 2014 in areas considered most likely to contain artifacts. The 2011 through 2014 archaeological surveys targeted sections where fire management activities are planned. Additional archaeological surveys conducted by power companies in association with various projects have been conducted. Most of the areas fire management activities are planned have been surveyed for cultural and archaeological resources.

Cultural Resource sites have been found on the ECTC. NH RSA 227-C:11 prevents the disclosure of these locations in a public document like the IWFMP. With the exception of initial attack suppression on a wildfire, all fire management activities must consult with the DMAVS/NHARNG CRM prior to beginning any activity that may cause disturbance to the ground. Known cultural resources will be identified in advance and avoided during fire management activities. If a previously unknown cultural resource is discovered during fire management activities, it will be flagged and avoided until an archaeologist can make a recommendation. The CRM will be the point of contact for information on locations of cultural resources on the ECTC. A map of archaeological sensitive and cleared areas is available from the Cultural Resource Manager for use in fire management activities.

The DMAVS/NHARNG will continue to conduct Phase 1A and Phase 1B archaeological surveys as required in areas where DMAVS/NHARNG projects and activities (defined under Section 106 of the NHPA as undertakings) have been proposed in order to identify: 1) any properties of archaeological significance within the areas tested, and 2) potential effects on properties listed, or potentially eligible for listing, in the National Register of Historic Places Additional details are available in INRMP Section 7.13.

Table 5 ECTC Fire Management Rare Species Conservation Measures

Species	Conservation Measures
Lepidoptera Including (Karner blue butterfly & Frosted Elfin)	12 burn units ranging in size from 1.4-4.5 acres have been established in PPSOW habitats to allow for implementation of burn rotation of 3-12+ years burning 1-4 units per year to sustain desire habitat and providing a patchwork of habitat conditions. Establish temporary firebreaks (mow lines) and conduct prescribed burning August 15th to May 15 outside the majority of the KBB active season. Burning is currently not planned for any primary habitat at the ECTC. Fire is not planned in the utility ROW where wild lupine is currently present. Should additional primary habitat be created no more than 1/3 will be burned in any one year and burning will only occur as necessary to support KBB. Burning will not occurring in the 2 management units with the highest lupine population in the same year. Burn or conduct other mechanical treatment on no more than 1/3 (18.5 acres) of secondary habitat in any one year. Conduct forestry/timber harvesting and mechanical treatments in KBB primary habitat prior to April 15th or after September 1st to avoid the KBB active season. Perform management in frozen conditions and or snow covered condition when possible. Mower blade height will be set preferably 6-8” from ground. Hand cutting of individual shrubs and brush can be done any time of year, primarily prior to April 15th or after September 1st to avoid the KBB active season. Construct new fire breaks and escape routes in KBB habitat prior to April 15th or after September 1st to avoid the KBB active season. Work in primary habitat will done in frozen conditions and or snow covered condition when possible. Maintain fire breaks prior to April 15th or after September 1st to the extent possible, when they are not also associated with security fence maintenance described below. Flag wild lupine to minimized disturbance in primary habitat. Wildland Fire Plan activities and burn plans will be coordinated with the local USFWS Field office during INRMP/IWFMP annual review.
Wood Turtle, Eastern Hognose Snake, Smooth Green Snake	Survey burn unit prior to ignition, brief & instruct burn crew to report any sightings to burn boss, use ignition patterns that reduce chances of wildlife entrapment (e.g. backing fire, spot ignition, flanking and inverted chevron), remove any individuals encountered outside burn unit.
Nesting Birds	Conduct prescribed burn, fuel reduction activities (mowing/forestry) and fire break construction and maintenance

	August 15th to 15 May avoiding primary nesting period. Survey burn unit prior to ignition, brief burn crew to report any sightings to burn boss.
Amphibian and reptiles	Avoid burning within 100 feet of vernal pools between snow melt and April 30th.
Northern Long-eared Bat	Conduct prescribed burns August 15th to May 15th outside pup season (June 1 to 31 July). Use firing techniques and prescription parameters to limit flame length to protect roosting bats. Conduct over story tree removal associated with fire break construction and maintenance November 1st to March 30th outside active season (1 April to 31 October). Hazard tree removal shall be conducted outside the pupping season (June 1st to July 31st) to the extent possible.

Water Resources

The Soucook River forms the northern and western boundaries of the ECTC. An unmapped perennial stream flows from the central wetland to the Soucook River. Fire management units have been established that buffer the river, flood plain forest and wetlands by at least 50 feet to the extent practical based on meeting ecological objectives for pitch pine-scrub oak vegetation and changes in landforms and slopes.

There are 3 vernal pools located on the property, 2 are located north of the Riverwood Drive entrance and the other is located within the wetland management unit (See INRMP Figure 37). During prescribed burns, a 100 foot buffer will be established around vernal pools and fire activities will be restricted from snow cover to late April to avoid impacts to critical migration periods for species.

A portion of the ECTC lies within the Town of Pembroke's Wellhead Protection Area (WPA) identified on INRMP Figure 17 and is regulated under the Town of Pembroke's Aquifer Conservation (AC) District overlay zoning. The purpose of these regulations is, in the interest of public health, safety, and general welfare; to protect, preserve, and maintain existing and potential groundwater supply and groundwater recharge areas within known aquifers from adverse development, land use practices, or depletion. A wellhead protection area is the surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field. The Town of Pembroke regulates land uses within the AC District which would contribute polluted water to designated aquifers identified as being needed for present and future public and private water supply. The wellhead protection area in the Town of Pembroke for the Pembroke Water Works wells has been reclassified as "GAA". This classification requires a higher level of protection because it contributes groundwater to a public water system and represents an area of high value groundwater for present or future groundwater supply.

The GAA classification increases the safety of the public water supply wells by prohibiting six high risk land uses (if such facilities do not already exist):

- Hazardous waste disposal facilities;
- Solid waste landfills;
- Outdoor bulk storage of road salt;
- Junkyards or vehicle salvage yards;
- Snow Dumps; and
- Wastewater or septage lagoons.

Fire management activities in the WPA will be managed by the Wildland Fire Program Manager in consultation with the Town of Pembroke Water Works supervisor. When using prescribed fire in the WPA, drip-torches and other pieces of equipment containing fuel will be filled off site to the extent possible and brought in to reduce chance of spills.

Fusees will not be used in the WPA. Spill kits will be on scene during all fire management activities. Class A foam will not be used in the WPA. If any spills occur call the DES Waste Management Division immediately (603)271-3899 (Monday through Friday, 8 a.m. to 4 p.m.), or the New Hampshire Department of Safety at (603)223-4381, 24 hours/day), unless all of the following conditions are met:

1. The discharge is less than 25 gallons.
2. The discharge is immediately contained.
3. The discharge and/or contamination is completely removed within 24 hours.
4. There is no impact or potential impact to groundwater or surface water.
5. There is no potential for vapors which pose an imminent threat to human health.

Wellhead Protection Areas/Aquifer Conservation District Standard Operating Procedure (SOP)

After consultation with the Town of Pembroke Water Works and New Hampshire DES a set of SOPs has been developed for actions within the Wellhead Protection Area/Aquifer Conservation District:

- Fusees will not be used during normal prescribed burn activities. Fusees may be used in emergency situations.
- Class A foam will not be used during normal prescribed fire activities. Class A foam may be used in emergency situations.
- Equipment such as drip torches, portable pumps and other gas powered tools will be fueled outside of the WPA, on paved sections of the WPA or in secondary containment with absorbent pads.

- Field fueling of equipment, if necessary, will be conducted with secondary containment and absorbent pads. Minimal amounts of extra fuels will be staged with secondary containment and absorbent.
- Road Vehicles (engines) will be fueled off site.
- UTV and ATVs will be fueled off site if trailed to the site or fueled with secondary containment and absorbent pads on paved surfaces.
- All fuel and other regulated substance container will remain close except when adding or removing the material.
- All equipment and vehicles will be checked for leaks and other mechanical issue that might cause a leak or loss of resource capability prior to being provided as a resource.
- Equipment or vehicles that begin leaking during a prescribed fire or wildfire will be immediately taken out of services unless needed to protect life or property.
- At least one spill recovery kit including absorbents, shovels, and containment device (Drum or multiple buckets) will be standard equipment on all prescribed fires.
- One of the DMAVS/NHARNG Emergency Response Coordinators will be present or available at the SMR to assist in the event of a spill.
- The procedures in the SOP will be distributed to all partners prior to the day of the burn and also included in the daily burn brief.

In addition to utilizing these procedures, the DMAVS will make every effort to minimize the use of petroleum based fuels as accelerants. Alternative drip touch mixtures are being pursued and at least partially used during prescribed fires. Drip torch mixtures composed of biodiesel and ethanol or biodiesel and E85 (ethanol/gasoline mixture) will continue to be pursued. Preliminary testing of limited quantities of biodiesel/ethanol and biodiesel/E85 mixtures were conducted on prescribe burns in 2016, 2017, 2018 and 2019 and found to be acceptable.

Use of a propane torch in 2017 was not found effective. While fuels were initially ignited residence time was not sufficient to maintain the fire requiring repeated passes ofver the same area.

Use of “Enviroburn” a commercially available alternative to conventional Diesel/gasoline mixture was purchased and used in 2019. While effective it is not free of petroleum and included toluene a known hazardous substance. 6 quarts of Enviroburn cost $35.95 making it not economical viable.

Availability of these alternative drip torch fuel component is problematic. A local source (within New Hampshire) of biodiesel has been found. E85 is currently not available in the state and an Industrial Alcohol User Permit is required from the U. S. Department of Treasury Alcohol and Tobacco tax and trade Bureau to purchase 100% pure ethanol. Other alternative methods will also be explored. At least one alternative method will be

utilized in each of the burns until alternatives are proven successful or no additional alternatives are available for testing.

DMAVS/NHARNG is pursuing a pollution prevention opportunity assessment in 2020 to evaluate additional aspects of biodiesel/ethanol mixture drip touch fuel.

SMR Natural Resource Considerations:

There are a number of rare threatened and endangered species on the SMR that would be affected by fire management activities. Prescribed burning on the SMR is focused on improving habitat for the KBB by maintaining PPSOW vegetation with grassy opening that contain wild lupine. Protection strategies will allow for burning of management units with wild lupine and potentially KBB, improving the habitat while minimizing direct loss of KBB resulting in a net benefit for the species.

Table 6 contains groups of species and conservation measures that will be employed.

Table 6 SMR Fire Management Rare Species Conservation Measures

Species	Conservation Measures
Lepidoptera including (Karner blue butterfly Frosted elfin)	23 management units each 1 acre or smaller have been established allowing for implementation of a burn rotation of 4-6 years or longer in units with lupine to allow lupine to regrow and species to repopulate and create a patchwork of habitat conditions. Establish temporary firebreaks (mow lines) and conduct prescribed burning August 15th to May 15 outside the majority of the KBB active season. Burn or other mechanical treatment on no more than 1/3 (5 acres) of the primary and secondary habitat in any one year. Do not burn the 2 management units with the highest lupine population in the same year. Burning units with lupine shall only occur as necessary to support KBB. Conduct forestry/timber harvesting and mechanical treatments in KBB primary habitat prior to April 15th or after September 1st to avoid the KBB active season. Perform management in frozen conditions and or snow covered condition when possible. Mower blade height will be set preferably 6-8" from ground. Hand cutting of individual shrubs and brush can be done any time of year, primarily prior to April 15th or after September 1st to avoid the KBB active season. Construct new fire breaks and escape routes in KBB habitat prior to April 15th or after September 1st to avoid the KBB active season. Work in primary habitat will done in frozen conditions and or snow covered condition when possible. Maintain fire breaks prior to April 15th or after September 1st to the extent possible, when they are not also associated with security fence maintenance. Flag wild lupine to minimized disturbance in primary habitat. Wildland fire management activities and burn plans will be coordinated with the local USFWS field office during INRMP/IWFMP annual review.
Nesting birds	Conduct prescribed burning August 15th to May 15th outside critical breeding times (preliminarily May 15th to August 1st). Continue to monitor bird nesting activity to ensure these dates are accurate.
Bats	Conduct prescribed burning August 15th to May 15th outside pup season (June 1st to July 31st). Conduct over story tree removal associated with fire break construction and maintenance November 1st to March 30th outside active season (April 1st to October 31st). Use firing techniques and prescription parameters to reduce flame length and intensity.

	Hazard tree removal shall be conducted outside the pupping season (June 1st to July 31st) to the extent possible.

Cultural Resources

There are no known or expected prehistoric resources on the SMR. Although no surveys have been performed within the SMR property, the area has been previously disturbed and no archeological resources have been identified in the past. Fire management activities are not expected to cause disturbance to the soil since control lines will be tied to existing roads eliminating the need for digging.

The New Hampshire State Historic Preservation Officer (SHPO) of the NH Division of Historic Resources issued a finding of "No Resources Present" for the SMR site in letters to the NHARNG dated December 2, 1998 and March 18, 1999. If any suspected artifacts should be discovered during fire management activities, a stop work order would be issued immediately and the NHARNG Cultural Resource Manager (CRM) would consult with the SHPO. Standard Operating Procedure no. 8 of the ICRMP will be followed for all inadvertent discoveries.

Chapter 3 - Wildland Fire Management

3.1 Goals and Objectives

DMAVS/NHARNG has established 5 overarching goals for the IWFMP. Specific objectives for each goal have also been established. Strategies and projects have been identified to meet the objectives. Strategies are generally administrative or recurring operation activities that are required or needed to meet the objective or support continuous operations. Projects are specific short term activities that produce a change in conditions that support an objective.

Goals of this Plan include:

- Ensure safety of all wildland firefighters and site users
- Minimize the effects of wildland fire on public health and safety
- Minimize effects of wildland fire on resources of value (cultural resources, T&E species, utilities, ground and surface waters).
- Manage Fire Dependent and Fire Adapted Natural Communities using prescibed fire as a primary mechanism for ecosystem management and mechanical treatment as a secondary mechanisim, to support INRMP implementation, reduce risk of wildfire and, support mission capabilities
- Mechanically treat (brontosaurus mowing) and/or conduct forestry operations to reduce fuels prior to ecological burns and when burn units are not capable of being burned within a specific burn rotation window.

Detailed Objectives, and Strategies and Projects are contained in Appendix D.

3.2 Wildfire Prevention

In the short period that NHARNG has owned the ECTC no wildfires have been reported. However, the area has had wildfires in the past and the potential is good that they will occur again. During the spring and fall when fine dead fuels are cured and available to burn, portions of the SMR are also susceptible to wildfire. The NHNGTS has fewer fire prone fuels than ECTC or the SMR; however the use of pyrotechnics during training and the large amount of personnel and equipment that regularly use the site increase the chance of a fire. Fire prevention is a cost effective way to reduce the threat of wildfire on DMAVS/NHARNG lands.

During development of this IWFMP meetings were held with the Town of Pembroke Fire Chief and the NH Division of Forests and Lands to discuss fire suppression response and prevention on the ECTC. The Town of Pembroke Fire Department requested that roads and trails on the ECTC be mapped and signed to facilitate suppression response. The town would like copies of the maps for their files. The DMAVS/NHARNG would like to coordinate ATV patrols with other agencies on the ECTC during periods of high fire danger. Both the town and state would like to conduct training exercises on the ECTC to increase familiarity with the property and improve response time. Annual meetings between the DMAVS/NHARNG, Town of Pembroke Fire Department and NH Division of Forests and Lands should occur to update contact information and ensure plans are current.

During development of this IWFMP meetings were held with the town of Strafford Fire Chief and the NH Division of Forests and Lands to discuss fire suppression response and prevention on the NHNGTS. Annual meetings between the DMAVS/NHARNG, Town of Strafford Fire Department and NH Division of Forests and Lands should occur to update contact information and ensure plans are current.

Fire prevention begins with an assessment of risks, hazards, values and fire history. These assessments prioritize the fire prevention needs by type and location. These assessments are an on- going process, re-evaluated as fires occur or conditions change.

Most likely, wildfires on the ECTC will be started by the public recreating on the site. Campfires, fireworks, and other incendiary devices used by the public have been observed on the ECTC in the past. Hunting and target shooting occur on the property. ATV use by the public occurs throughout the property. It is expected that these activities will continue. Historically fires on the ECTC have begun along the Soucook River corridor (campfires, arson) and along the powerlines (ATV equipment). Another source of wildfires has been traffic accidents and car fires along Rt. 106/Sheep Davis Rd. On two occasions these fires have spread and moved onto or threatened what is now the ECTC.

The potential exists for wildfires to start on the SMR from equipment use that produces sparks (welding, grinding, mowing); a vehicle or structural fire that moves into fine dead fuels; or sparks produced from powerline or transformer issues.

Wildfire on the NHNGTS may occur during training operations that use pyrotechnics; from equipment use that produces sparks; or from members of the public (hunters, ATVs) using the property.

Wildfire prevention strategies have 4 components- Education, Enforcement, Engineering, and Administration.

Education strategies for DMAVS/NHARNG lands should include:

- Presentation of fire prevention and awareness topics at staff meetings prior to beginning of fire season (April-July/September-November).
- Include fire prevention and awareness in trainee briefings. Include as topics what to do if encountering a wildfire, fire restrictions, natural resource concerns.
- Fire prevention signs posted in buildings and roads where staff and the public will see them.
- Direct communication with public about fire prevention when on DMAVS/NHARNG land.

Enforcement strategies for DMAVS/NHARNG lands should include:

- The DMAVS/NHARNG in cooperation with the FPB and Town of Pembroke should begin patrols of the ECTC during periods of extreme fire danger.
- Adhere to Training Restriction matrix as shown in Table 7.
- Equipment used on DMAVS/NHARNG land should be inspected for fire safety compliance (spark arresters, etc.).
- Investigate all fires and submit a report to FPB.

Engineering strategies for DMAVS/NHARNG lands should include:

- Post signs that state restricted activities on the site, to include no camping or campfires.
- Implement prescribed burning to reduce fuels.
- Roads to the interior of the ECTC should be repaired and signed to improve emergency vehicle access.

Administrative strategies for the ECTC should include:

- Provide Town of Pembroke and FPB with map of roads and trails on ECTC.
- Partner with local and state agencies on fire prevention projects.
- Run cooperative readiness drills with Town of Pembroke and Town of Strafford Fire Departments to ensure local suppression forces can access the ECTC and NHNGTS, navigate the road systems, and work with NHARNG partners effectively.

- Communication between the DMAVS/NHARNG , Town Fire Departments, and NH Division of Forests and Lands to update contact information and ensure agreements are current.

For more information on developing a Wildfire Prevention Plan see the following link:

http://www.nwcg.gov/pms/docs/wfprevnttrat.pdf

3.3 Risk Assessment

Personnel involved in fire management activities on DMAVS/NHARNG lands should familiarize themselves with the following information before conducting fire suppression, prescribed fire or fuel reduction projects.

Fire Seasons

Although wildfires can occur in New Hampshire at any point where fuels, oxygen, and heat coincide, there are three distinct seasons when most fires happen:

Springtime after snowmelt but prior to leaf out/green up. During this period the dead cured material left over from the previous year's growth are uncovered and dried by radiant heat. Deciduous trees and shrubs have not begun to leaf out and sunlight penetrates into what typically are closed canopies. Fine dead fuel moistures are low and until the growing season begins live fuel moistures are low. On average this period occurs between the months of late March to early June. Typical causes of fire during this period are debris burning by homeowners, downed powerlines, and automobile/equipment fires. These fires can exhibit rapid rates of spread in available fuel types but will gradually lose energy as they move into wetter soils. Generally soil moistures at this time of year are high enough that fire will only consume the top most layer of forest litter. Typical indices for this period are: KBDI 200-400, 1 hour fuels 4-10%, 10 hour fuels 12-25%, and BI 20-30.

Another reliable fire season occurs during the fall after a frost has killed and dried vegetation and leaves have fallen but ground is still snow free. This typically occurs from late October to mid- December. Fires during this period can exhibit rapid rates of spread due to gusty autumn winds. Soil moistures can be lower as well, moving the fire deeper into the duff layer. Fall season fires are usually caused by recreational activities like hunting or campfires. Typical indices for this period are KBDI-400-600, 1 hour fuels 4-10%, 10 hour fuels 12-25%, and BI 20-30.

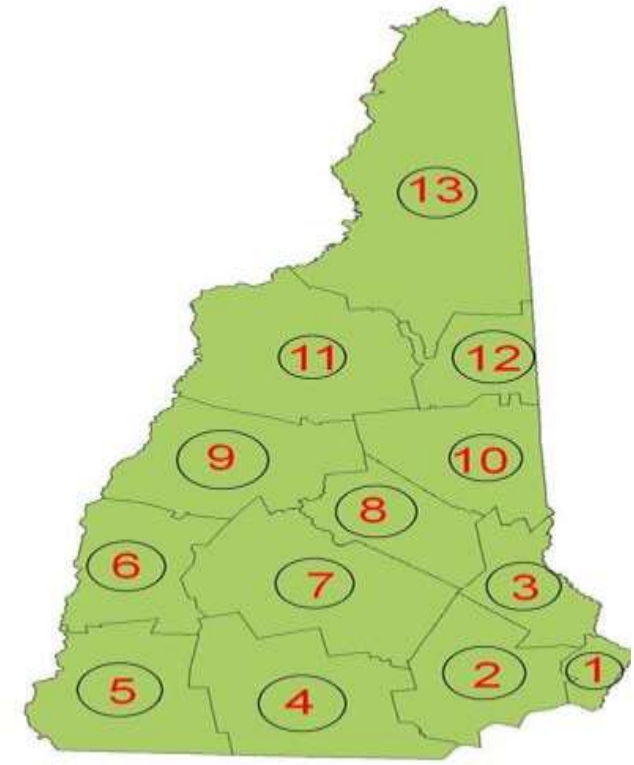
Summer fire seasons occur during droughty periods and are not as consistent as spring and fall seasons. The drought can be regional or very local. 10 days or more without rain is sufficient to dry surface fuels enough to support fire despite high live fuel moisture in surrounding vegetation. If the drought persists long enough to affect live fuel moistures the risk is elevated. Fires during this period can spread rapidly and move

deep into the duff layer, making suppression difficult. Thermal belts are not uncommon during these periods. These fires are usually caused by lightning and recreational activities. These growing season fires are tied to fire adapted habitats in NH. Typical indices for this period are KBDI 400-800, 1 hour fuels 4-10%, 10 hour fuels 12-25%, and BI 20-30.

Fire danger ratings are measured and reported daily by the New Hampshire Division of Forest and Lands and expressed numerically as Class Days. Class Days are calculated by plotting the Buildup Index (BUI) and the Spread Index. BUI is a relative measure of the cumulative effect of daily drying factors and precipitation on fuels with a ten-day timelag. Spread Index indicates the relative rate of fire spread in a given fuel type.

Class Days are applied to 13 Fire Danger Zones (Figure 2) which roughly correspond to the 10 NH counties. Grafton and Carroll counties have a north and south Fire Danger Zone, and Rockingham an east and west zone. The SMR and the ECTC are covered by Fire Danger Zone 7. The NHNGTS is covered by Fire Danger Zone 3. Each zone is given a Predicted Class Day Rating (Figure 3).

Figure 2 NH Fire Danger Zones



***WHAT DOES THE CLASS DAY MEAN?**

Class 1: *Low* Fires are not likely, it may be raining.
Class 2: *Moderate* Fires are possible in light fuels, day after a rain.
Class 3: *High* Fuels in open areas and sunny slopes may spread rapidly.
Class 4: *Very High* Fires start easily from all causes. Fires spread and increase in intensity rapidly. Spot fires occur. Fire will burn deep, except in the spring.
Class 5: *Extreme* Fires will spread very rapidly with severe spotting. Difficult to extinguish, mop-up requires a great deal of effort

This information is available at http://www.nhdfl.org/fire-control-and-law-enforcement/daily-fire-danger.aspx (866) 643-4737 or 603-271-2259.

Figure 3 Predicted Class Day Rating Example*

FIRE DANGER ZONES	PREDICTED CLASS DAY
One	1
Two	1
Three	1
Four	1
Five	1
Six	1
Seven	1
Eight	1
Nine	1
Ten	1
Eleven	1
Twelve	1
Thirteen	1

National Fire Weather Forecasts

The National Weather Service's (NWS) Fire Weather Program provides forecast, warning, and consultation services for the prevention, suppression, and management of wildland fires and for a host of land management activities. These meteorological services are built to meet the weather requirements of federal and state wild land managers. Fire weather forecasts for the DMAVS/NHARNG's SMR, ECTC and NHNGTS are produced from the NWS Gray, Maine office. This office is responsible for daily fire weather predictions, red flag and fire weather watch announcements and spot weather forecasts. The following links access products and services for the DMAVS/NHARNG operating area:

NWS Gray, Maine office fire weather forecast:
http://www.nws.noaa.gov/view/prodsByState.php?state=ME&prodtype=firewx

NWS Gray, Maine office additional fire weather related info:

http://www.erh.noaa.gov/gyx/firewxintro.htm

NWS Gray, Maine office point forecast for NHARNG property (Concord Municipal Airport):

http://forecast.weather.gov/MapClick.php?lat=43.20455018831656&lon=-71.50031089782715

Spot weather forecast request:

http://www.erh.noaa.gov/gyx/spot_forecast.htm

Further weather and fuels information including drought and climatology data specific to the Eastern US and New Hampshire can be found at:

http://gacc.nifc.gov/eacc/predictive/weather/weather.htm

Remote Automatic Weather Station (RAWS) at Bear Brook State Park, Allenstown, NH approx.10-14 miles from NHARNG ECTC:

http://raws.wrh.noaa.gov/cgi-bin/roman/meso_base.cgi?stn=TS849&time=GMT

Adhere to the following metric for training restrictions on the ECTC/NHNGTS:

Table 7 Training Restrictions on ECTC/NHNGTS

Fire Class Day	Restrictions
Class 1 Day- Low Fire Danger	No training restrictions.
Class 2 Day- Moderate Fire Danger	No training restrictions
Class 3 Day-High Fire Danger	Minimize use of pyrotechnics. Consider engineering controls to mitigate risk (see Class 4 day). Further training restrictions TBD. Coordinate daily ATV patrols on the ECTC & NHNGTS with FPB and local fire department.
Class 4 Day-Very High Fire Danger	Limit use of pyrotechnics to areas cleared of wildland fuels (10ft) and/or contain in none burnable item such as metal drum. Further training restrictions TBD. Coordinate daily ATV patrols on the ECTC & NHNGTS site with FPB and local fire department.
Class 5 Day-Extreme Fire Danger This is an extremely rare event in New England.	PYROTECHNICS NOT ALLOWED. During extreme fire danger catastrophic fires are possible due to unusual weather conditions. Consider suspension of field training exercises until fire danger lowers. Forest fires could destroy training lands, endangered species habitat, facilities and structures located in forested areas. OPEN FIRES ARE NOT ALLOWED

3.4 Wildfire Suppression Initial and Extended Attack

Initial Attack is defined as the actions taken by the first resources to arrive at a wildfire or wildland fire use incident. Initial actions may be size up, patrolling, monitoring, holding action or aggressive initial attack.

Extended Attack is defined as a wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander. Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

There is limited firefighting staff and equipment on the SMR and none currently on the ECTC and NHNGTS. All wildfire suppression response will be through Concord, Pembroke, and Stafford Fire Departments. The Wildland Fire Program Manager will coordinate with the ECTC Administrative Officer and the Concord and Pembroke, or Stafford Fire Departments to establish protocols for wildfire suppression response under unified command. These protocols will be revisited on an annual basis to make sure the information is current.

All Extended Attack on the ECTC and SMR will be through the Capitol Area Mutual Aid and the State of New Hampshire Division of Forest and Lands. Extended Attack on the NHNGTS will be through Lakes Region Mutual Aid and the State of New Hampshire Division of Forest and Lands. During Extended Attack, the DMAVS/NHARNG Wildland Fire Program Manager may participate as an Incident Commander, a Liaison, or an Agency Administrator under a Unified Command structure.

3.5 Fire Breaks

DMAVS/NHARNG will use a combination of paved roads, improved gravel/dirt roads, unimproved dirt roads/trails and vegetative fuel breaks as firebreaks. Maintenance of pave roads and improved gravel/dirt roads will not be address in this plan. Establishing and maintaining unimproved dirt roads/trails and vegetative fuel breaks will be addressed. Additionally temporary mowed fuel breaks will be created along burn unit boundaries that don’t other wise have a fire break and/or other location in a burn unit needed for conttroling where fire is allowed to burn in preperation of planned prescribed burns. These temporary mowed fuel breaks will be allowed to regrow until needed for future prescribed burns.

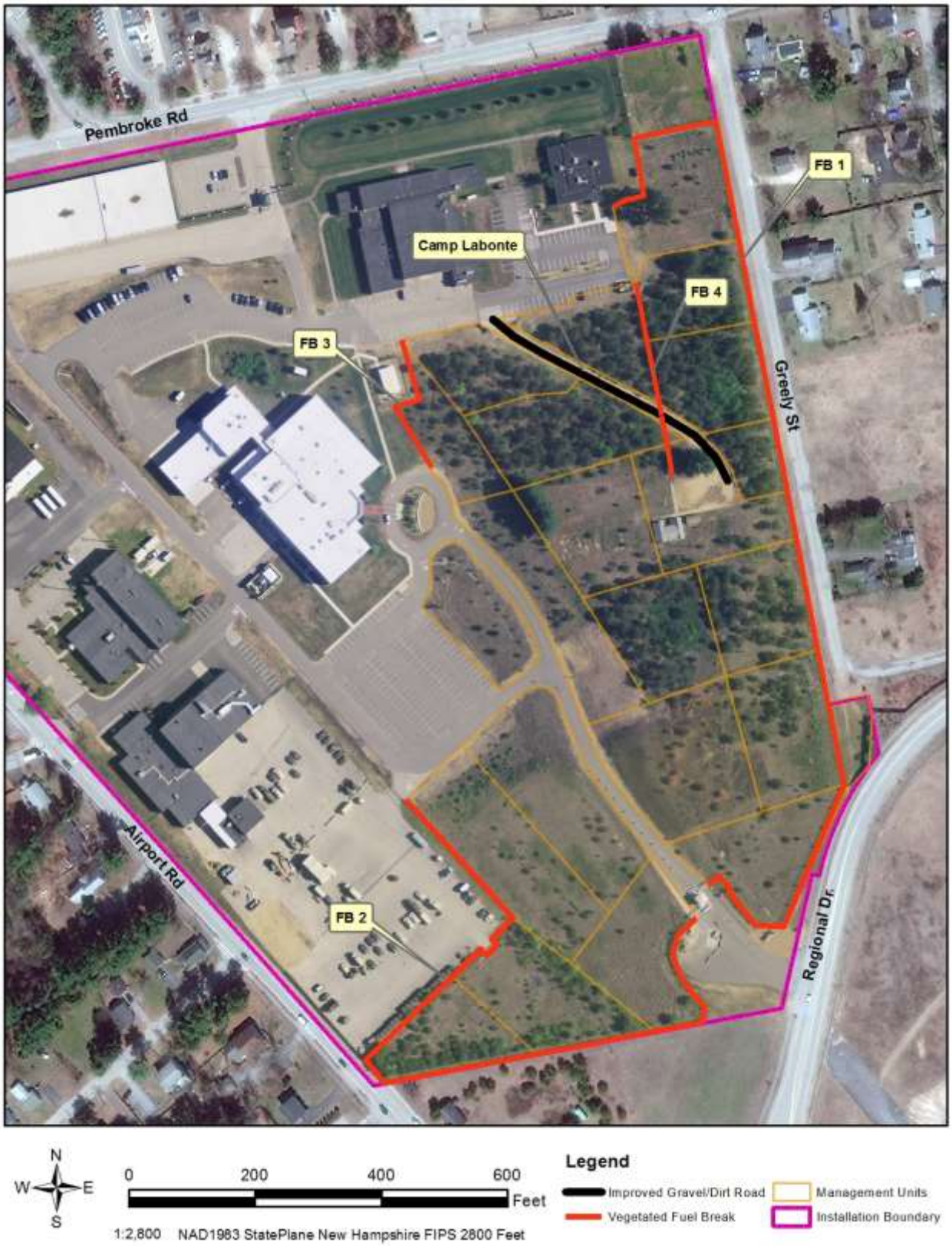
SMR

The burnable area of the SMR is almost entirely surrounded by paved roads and parking lots. These roads and parking lots form anchor points from which to establish addition fire breaks to protect other on and off site infrastucture. The SMR has an improved gravel road that provides vehicle access to the KBB captive rearing building and a number of the fire management units. It also provide a non-burnable fire break.

The majority of the remaining permanent fire breaks at the SMR will be along the perimeter or interior security fencing. A 10 foot mowed or cleared area on the interior and exteroir of the security fencing is needed for visual and physical inspection. A portion of the security fencing cleared area is utilize by a stone dust running/walking path begining in the USPFO parking lot, running along Greeley Street and Regional Drive and ending near the Minuteman Way guard shack. Additional sections of the SMR security fencing cleared area needs to be established as identified in Table 15 in Appendix E and Map 9. Mowing and maintenance of these security fence clearance areas including fire break 3 (Map 9) will occur on a regluar basis, potentially weekly (Photo 9). Fire break 4 (Map 9) should be cleared on an annual basis to limit growth unter the communication line. Temporary mow lines will be established around individual management unit prior use of prescibed fire and then allowed to regrow.

Photo 9 SMR firebreak adjacent to Greeley Street

Map 6 SMR Roads and Firebreaks



ECTC

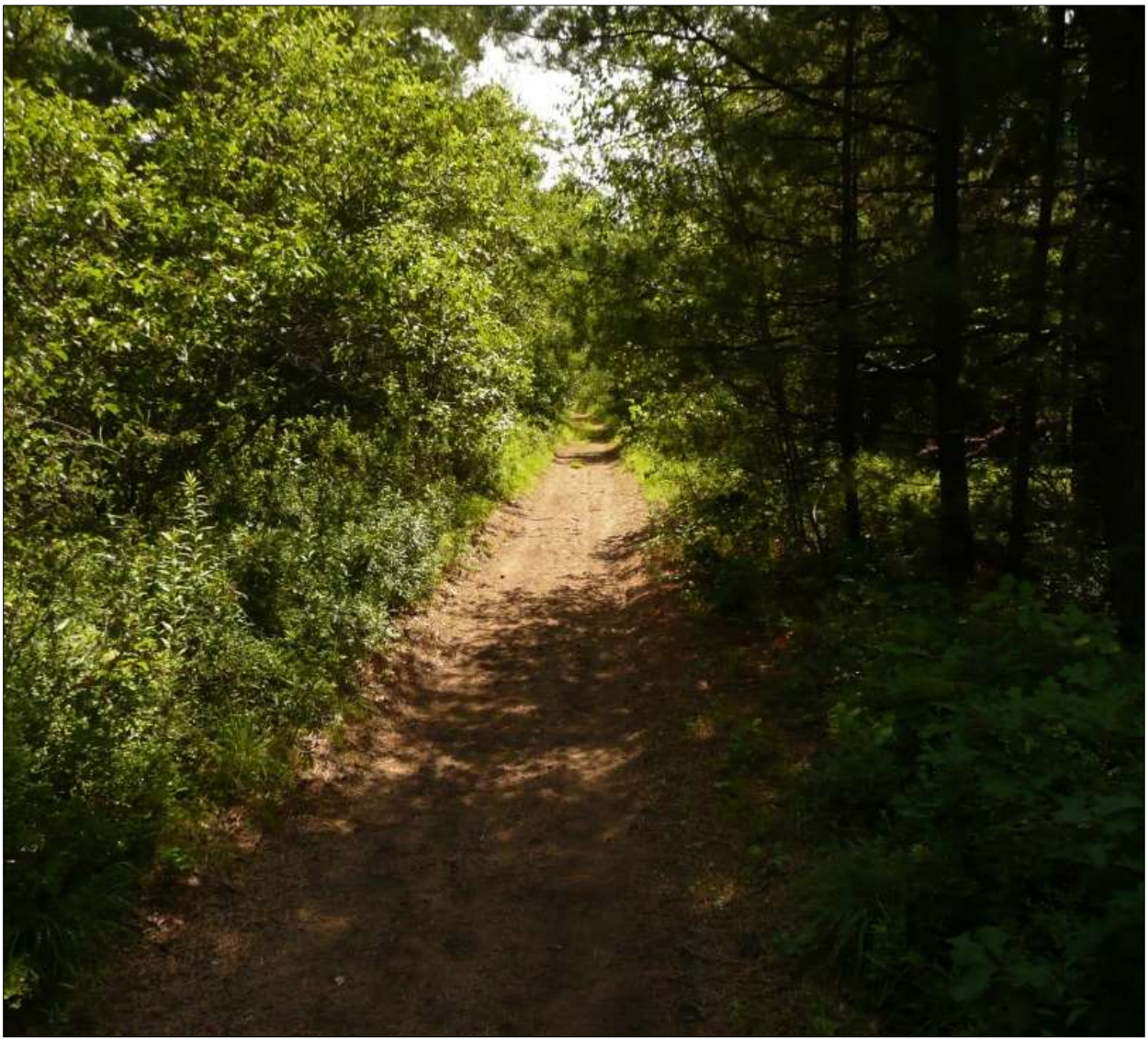
ECTC firebreaks include the Soucook River which runs along the northern and western boundary of the site and will act as an effective fire break in all but the most extreme fire conditions. ECTChas a network of roads along the powerline corridor and in the interior (Photo 10). These roads should be maintained and improved. **Error! Reference source not found.** in Appendix E outlines needed maintenance and construction of improved gravel/dirt roads, unimproved dirt roads/trails and,vegetative firebreaks. These activities will help meet objectives for fire suppression response and natural community restoration for the next 5 years. 1.6 miles of firebreak will be constructed and 1.89 miles of trail/roads will be repaired or maintained. (Note: Readiness Center Perimeter trail is being constucted and maintained as part of the RC and was perviously evaluated under a seperate EA.)

Maintenance along unimproved roads and trails will be needed every 2 to 5 years. Mowing or cutting back vegetation on both sides of the road/trail 5-6 feet will be sufficient. This reduces area of wildland fire fuel in combination with the exisiting unimproved dirt/road/trail will provide sufficient primary fire breaks.

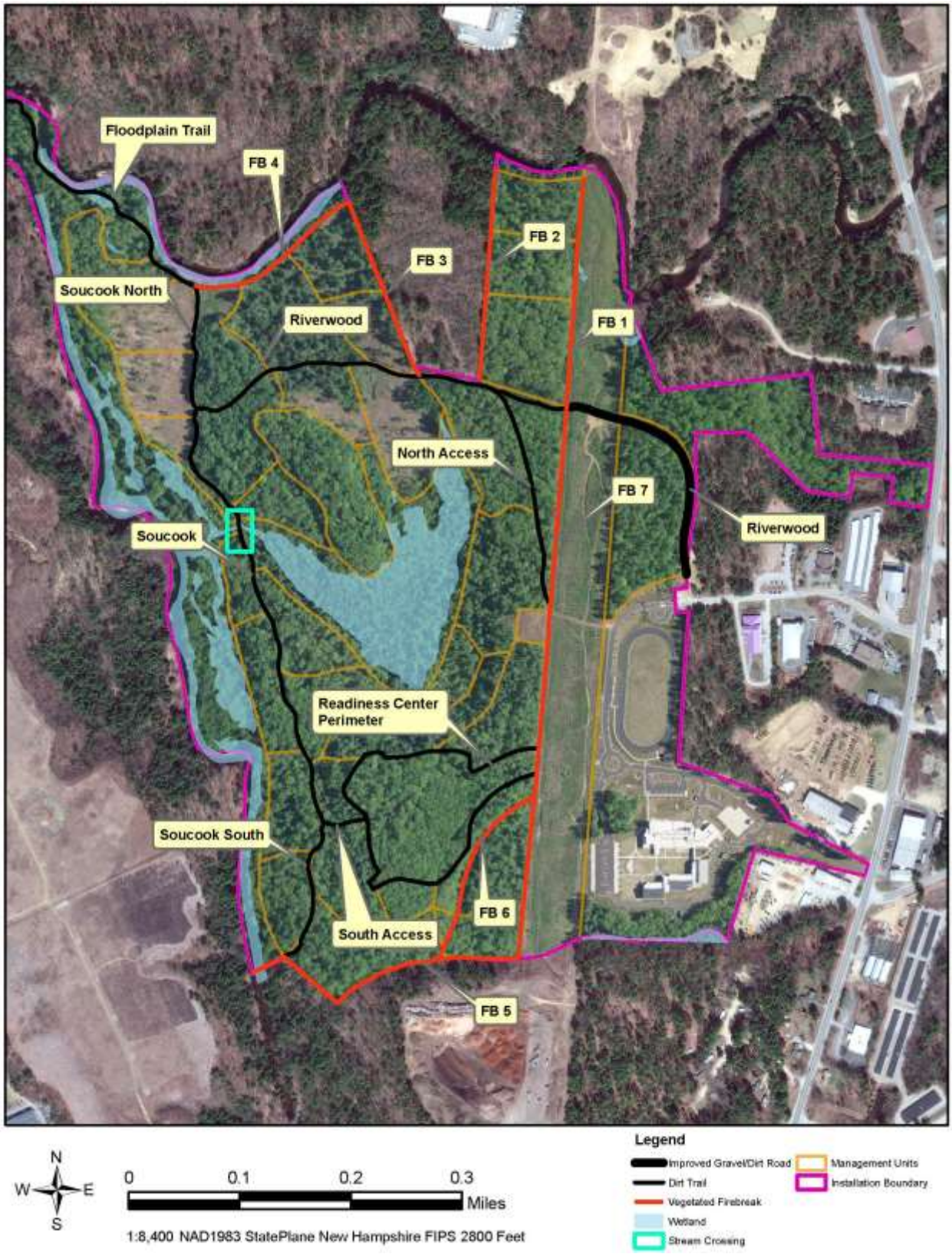
Fire breaks 1-7 will be considered seconday fire breaks consisiting of fuel breaks. Fire Breaks 1 and 7 along the utility ROW may be mowed once annually 10-12 feet in width depending rates of regrowth. Fire breaks 2-6 should be 10-12 wide with reduced shrubs and forest debris and removal of latter fuels (limbs) on canopy trees up to 8-10 feet. They may be shaded or partially shaded by canopy trees. Fire breaks 2, 5 and 6 will need the most work and potentially require more than 1 year to be established. These fire break should be usable by UTV and maintatined every 2- 5 year as needed.

To provide access along the Soucook Trail for utility vehicles (UTVs) such as a John Deer Gator or Polaris Ranger a small bridge will need to be constucted across the perenial stream draining the central wetland. This bridge will allow for firefighter access and critical escape route should other paths of escape be compomised or blocked. The stream is 12 feet wide from the top of the banks. The bridge should be able to be contructed from the banks avoiding work in the stream/wetlands. The bridge would be expected to be approximately 12 in length and 8 feet wide. Map 7 shows the location of this stream crossing.

Photo 10 Overgrown fire break ECTC



Map 7 ECTC Roads and Firebreaks



NHNGTS

The NHNGTS has a series of man-made and natural firebreaks in place that will aid in restricting fire growth. There are only a few spots on the property where additional breaks are needed. Map 8 show the locations of existing fire breaks.

Existing firebreaks include:

- A series of range roads running north/south and east/west that divide the grasslands and will help limit fire spread in these areas.
- The range road running north/south through the forested portion of the NHNGTS.
- A wetland complex extends through the north central section of the property and will act as a firebreak except during extreme drought.
- A Class 6 town road (Johnsonboro Road), is adjacent to the north boundary of the NHNGTS and provides a firebreak as well as access on and off the property. There is a gate between the range road and Johnsonboro Road.
- Stone walls are scattered throughout the property including along the property boundary. These walls will help check the spread of fire temporarily.

Adding a 10-12 foot wide shaded fuel break along the dry forested portions of the NHNGTS boundary would improve access for firefighters responding to a wild fire and reduce fire behavior. Approximately 5000 feet' of firebreak could be created. DMAVS/NHARNG will evaluate need for shaded firebreaks and establish any high priority firebreaks during the plan period. The shaded fuel break will involve creating a cleared path including removing of trees as needed, reduced surface fuels such as forest debris and shrub cover, and reducing latter fuels on canopy trees to a height of 10-12 feet.

For more information on shaded fuel breaks see the following link:

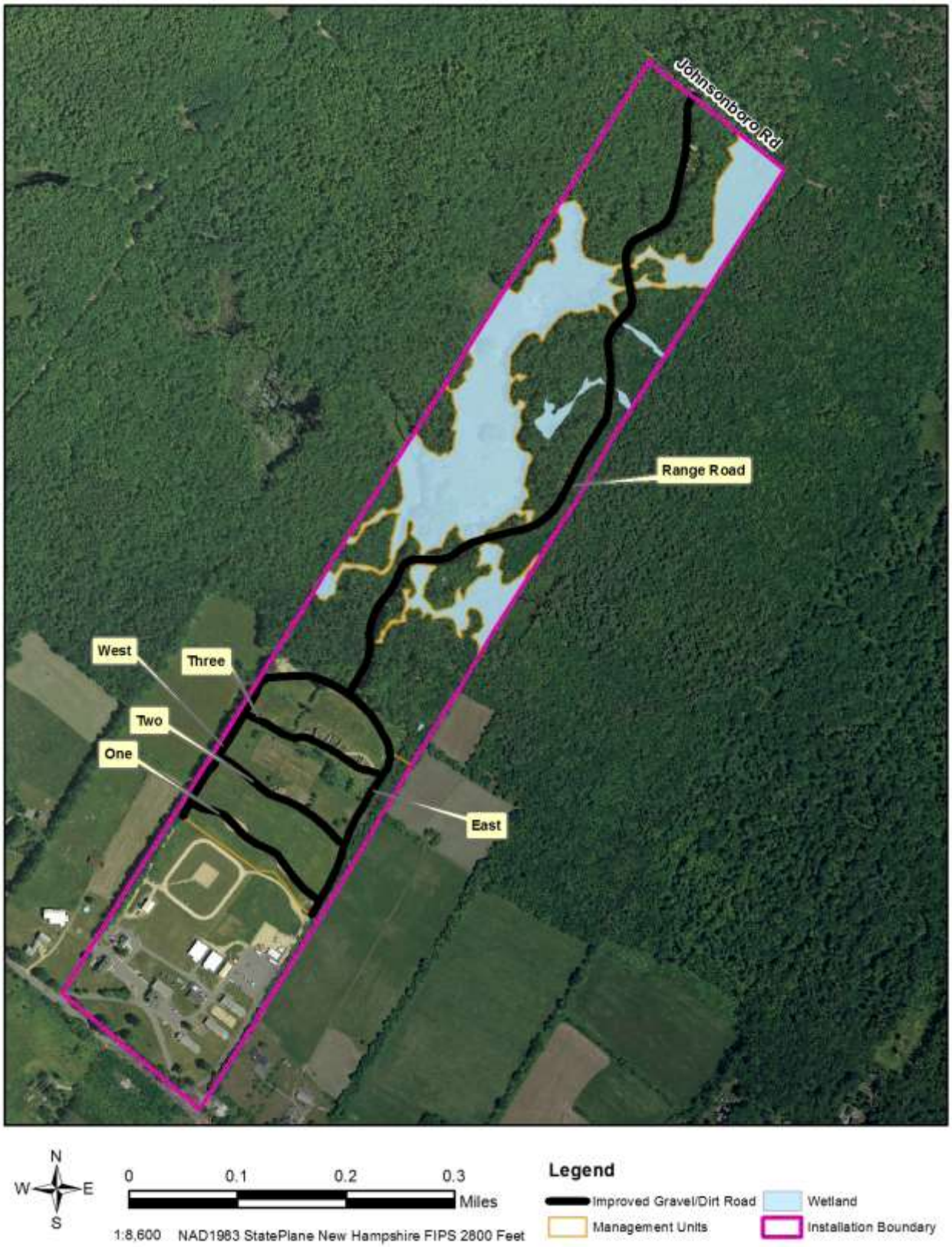
http://www.fs.fed.us/psw/publications/skinner/psw_2000_skinner%28agee%29001.pdf

Additional details for the NHNGTS fire breaks are located in Appendix E Table 17.

Photo 11 Range Road Firebreak

Photo 12 Wetland Natural Firebreak

Map 8 NHNGTS Roads and Firebreaks



3.6 Monitoring

In wildland fire operations, monitoring is the collection, analysis, and interpretation of environmental data to evaluate management's progress toward meeting objectives, and to identify changes in natural systems. Monitoring is also conducted on wildland fires to observe fire effects, fire behavior, or both. For example, the work done by Fire Effects Monitor (FEMO) or Field Observer (FOBS) positions.

DMAVS/NHARNG staff have collected pre-monitoring data for plant and animal species found on the NHNGTS, ECTC and SMR. This information can be used to gauge success in meeting objectives for habitat restoration and maintenance.

The following elements will be monitored by DMAVS/NHARNG staff or cooperators/contractors during fire management activities:

- Pre Burn Fire Weather and Fuel Observation: Weather will be monitored one week prior to the expected burn window and continue throughout the entire burn window. This information will provide valuable information on when a burn can be conducted that will best meet the unit objectives. Daily, one week prior: dry bulb, relative humidity, average daily wind speed, percipitation amounts. This information can be gathered from the RAWS weather station at Bear Brook State Park or CMA. Pre Burn Fire Weather and Fuel Observation sheet is located in Appendix F. In additional on-site weather condition will be collected as many week days as possible to suppliment established wether station data and identify on-site differences from predicted conditions.

- Day of Burn Weather and Fire Behavior Observations: On the day of burn and hourly throughout the burn: dry bulb, wet bulb, relative humidity, max wind speed, average wind speed, wind direction, fine dead fuel moisture and probability of ignition will be recorded. This information is to be collected in the unit at the site of the burn. Day of Burn Weather and Fire Behavior Observation Sheet is located in Appendix F.

- Smoke Management: On the day prior to a burn and on the day of the burn use of the NH Department of Environmental Services website Air Quality Forecast or Air Quality Current Data pages will be checked to identified air quality conditions that would be affected by prescribed burn smoke. Direct contact with the Air Resources Divsions will be made if question remain. On the day of the burn a person on the burn crew will be identified as a look-out to identify any smoke management issues surrounding the site. This individual will continually survey surrounding public roads, residence and businesses for smoke that could pose a hazard to either human health or visibility concerns. This person will be in constant communication with the burn boss and will report conditions as needed or upon request. Smoke observervations will be recorded on the Day of Burn Weather Monitring Sheet.

- Vegetation Monitoring: Vegetation Monitoring is described in the INRMP and is designed to determine the need for management actions including prescibed fire to meet target vegetation composition and other habitat characterisitics.

- Post Burn Fire Effects Monitoring: DMAVS/NHARNG will conduct post burn fire effects monitoring using the Post Burn Severity Worksheet. Evaluation of burn severity for duff/litter, slash & 10 hour fuels, herbaceous vegitation, woody vegetation , 1 meter, woody vegetation 1-3 meters and woody vegetation > 3 meters will be evaluated shortly after all prescribed burns. The burn severity will be used to evaluated effectiveness of the prescribed burn to meet burn objectives. These objectives are tied to the target vegitiation described in the INRMP. The Post Burn Severity Worksheet is located in Appendix F.

- Fuel Load: All PPSOW and DAOF units will be monitored every 5 years. Monitoring between these intervals may be conducted as needed to support specific prescribed burns. This will help determine priorities for units that have a high risk for fire potential. Brown's transect protocol will be used to measure fuel loads. http://www.bia.gov/cs/groups/xnifc/documents/text/idc012457.pdf. See Appendix G for ECTC fuel load data collected in 2014. Fuel load data surveys in other fuel types will be collected as needed to fill in data gaps over time.

Chapter 4 - Prescribed Burns

4.1 Prescribed Burn Goals and Objectives

Prescribed fire is defined as any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, a fire permit issued and NEPA requirements must be met, prior to ignition. All prescribed burning on DMAVS/NHARNG lands will be conducted by qualified individuals. Safety of firefighters and the public will be the highest objective during all burns.

Primary goals of prescribed fire on DMAVS/NHARNG lands are maintenance and restoration of fire adapted communities and plant and animal species; hazardous fuel reduction; removal of non-native species and maintaining grasslands.

Providing fire fighter training opportunities including identification of position specific trainees with open task books to facilitate meeting qualification and certification requirements is also an objective that should be identified on all prescribed burns.

Specific goals and objectives for prescribed fire on the NHNGTS include:

Goals:

- Maintaining grassland for grassland birds and field training activities.
- Reduce fuel loads to minimize the risk of wildfire on the NGNHTS.

Specific objectives for individual prescribed fire will be developed during the planning phase of each prescribed fire. Objective will likely include one of more of the following:

- Consumption of herbaceous fuels
- Reducing litter
- Reducing shrub layer cover
- Reducing or top killing invasive and undesirable species.

Specific goals and objectives for prescribed fire on the ECTC include:

Goal 1:

- Maintain existing and restore previous mapped pitch pine - scrub oak woodland natural community on the ECTC and to support rare species populations dependent on this community.
- Reduce fuel loads to minimize the risk of wildfire on the ECTC.

Specific objectives for individual prescribed fire will be developed during the planning phase of each prescribed fire. Objective will likely include one of more of the following:

- Reducing 10 hour fuel loads.
- Reducing litter and slash

- Reducing duff
- Reducing shrub layer cover
- Reducing or top killing invasive and undesirable species.
- Increasing or maintaining grassy opening cover

Goal 2:

- Maintain Dry Appalachian Oak Forest on ECTC
- Reduce fuel loads to minimize the risk of wildfire on the ECTC.

Specific objectives for individual prescribed fire will be developed during the planning phase of each prescribed fire. Objective will likely include one of more of the following:

- Reducing 10 hour fuel loads.
- Reducing litter and slash.
- Mortality of understory species.
- Oak regeneration.

Specific goals and objectives for prescribed fire on the SMR include:

Goals:

- Maintain rare species and grassy openings associated with the pitch pine - scrub oak natural community on the SMR.
- Reduce fuel loads to minimize the risk of wildfire on the SMR.

Specific objectives for individual prescribed fire will be developed during the planning phase of each prescribed fire. Objective will likely include one of more of the following:

- Invigorating wild lupine
- Reducing litter
- Reducing duff
- Reducing 10 hour fuel loads
- Reducing shrub layer cover
- Reducing or top killing invasive and undesirable species.

4.2 Responsibilities

The Wildland Fire Program Manager (WFPM) has primary responsibility for coordination of prescribed burning on DMAVS/NHARNG lands. In accordance with the Army Wildland Fire Policy Guidance memo dated September 4, 2002, the WFPM will approve all burn plans. The approval authority on NWCG burn plans is the “Agency Administrator”. The WFPM will sign as the approving authority and provide ignitions authorization to the Burn Boss (RxB). Should the WFPM perform as the RxB alternate

approval will be requested higher up the chain of command. The WFPM will sign state burn permits as the landowner's agent.

WFPM will ensure that all DMAVS and NHARNG personnel, contractors and partners involved in prescribed burning will meet training and certification standards for either NH Prescribed Fire Council or National Wildfire Coordinating Group for the position they occupy.

The WFPM will delegate a NWCG or NHPFC qualified RxB for each prescribed burn. The WFPM or a designated alternate, will ensure that all planning is complete for proposed burns and that the Prescribe Burn Plan and Complexity Worksheet is prepared and handed over to the Burn Boss in charge of an individual burn.

The RxB will serve as Incident Commander (IC) for the prescribed burn and ensure that all procedures and standards are met. The RxB will establish command under the Incident Command System. The RxB will ensure that the Prescribed Burn Plan and any maps are on location the day of the burn. The RxB will follow the Burn Plan and any additional instructions identified by the WFPM in the ignitions authorization.

When the burn is complete the RxB will return the burn plan and worksheet to the WFPM for evaluation of the burn, filing the forms and adding the burn information into the prescribed burn documentation.

4.3 Elements of the Burn Plan

The DMAVS/NHARNG will use the most current National Wildfire Coordinating Group (NWCG) Interagency Prescribed Fire Planning and Implementation Guide (PMS 484) to develop burn plans. Use of the New Hampshire Prescribed Fire Council (NHPFC) burn plan template may be used in cases where only state and local personnel will be utilized. NWCG burn plan includes the following elements: NHPFC Burn Plan Template can be found at the NHPFC Publications page https://extension.unh.edu/resource/new-hampshire-prescribed-fire-council-publications .

Section 1. Landowner Information

Section 2. Rx Burn Planner Information

Section 3. Rx Fire Location Information

Section 4. Signature Page

Section 5. Description of Prescribed Burn Area

Section 6. Description of Adjacent Areas

Section 7. Goals

Section 8. Management Objectives

Section 9. Prescription

Section 10. Minimum Crew and Equipment Levels

Section 11. Ignition, Containment & Mop Up Plan

Section 12. Contingency Plan and Minimum Resources/Maximum Response

Section 13. Minimum Resources and Maximum Response Time

Section 14. Smoke Sensitive Areas & Facilities

Section 15. Techniques to Reduce/Mitigate Smoke Impacts

Section 16. Potential Hazards and Measures Taken to Reduce Hazards

Section 17. Escape Routes and Safety Zones

Section 18. Nearby Emergency Facilities

Section 19. Weather Monitoring

Section 20. Public/Abutter Notification

Section 21. Permitting

Section 22. Maps and Other Figures

Section 23. Attachments to Burn Plan

Pre-burn Go/No Go Checklist

Crew Briefing Checklist (for day of burn)

Complexity Analysis Worksheet

Others as desired.

4.4 Fire Management Units

4.4.1 NHNGTS

The NHNGTS plans to use prescribed fire or mechanical treatment to maintain grassland to benefit nesting birds and field training. A total of 15.2 acres may potentially be treated with prescribed fire although many of the management units have important training features that will need to be protected. Temporary mowed fire breaks can be created around training features prior to prescribe burning. Existing gravel roads will be used as primary unit boundary and fire breaks.

Table 8 NHNGTS Fire Management Units

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy*	Comment
Grass 1	G1	-71.125394 43.274304	1.7	GR2	620’	Northeast	2	Mechanical and rx fire to maintain grassland community	Nesting birds
Grass 2	G2	-71.124943 43.274646	4.6	GR2		Northeast		Mechanical and rx fire to maintain grassland community	Nesting birds
Grass 3	G3	-71.124415 43.27533	5.1	GR2		Northeast		Mechanical and rx fire to maintain grassland community	Nesting birds
Grass 4	G4	-71.124033 43.276061	4.2	GR2		Northeast		Mechanical and rx fire to maintain grassland community	Nesting birds
Forest 5	F5	-71.122709 43.277475	17.1	TL3		Northeast		Mechanical Treatment and suppression	Small Whorled Pogonia
Forest 6	F6	-71.119221 43.280299	15.1	TL3		southeast		Mechanical Treatment and Suppression	
Forest 7	F7	-71.118044 43.283213	12.8	TL3		East southeast		Mechanical Treatment and Suppression	

Map 9 NHNGTS Fire Management Units

ECTC

The ECTC was purchased in 2009 for construction of the facilities to house the regional Training Institute. Construction of an Army National Guard Readiness Center and State Active Duty Annex is scheduled for 2019-2020. The ECTC contains approximately 16 acres of PPSOW habitat, 145 acres of DAOF habitat, 20 acres of disturbed grassland/shrubland in the powerline ROW, 10 acres of red maple swamp, 15 acres floodplain habitat and 2.5 acres of hemlock/white pine habitat. 23.5 acres of what is currently DAOF habitat will be restored to PPSOW habitat.

A past history of forest management is evident, especially in the Dry Appalachian Oak Forest (DAOF). An Integrated Wildland Fire Management Plan, State Owned properties, Concord and Pembroke NH dated September 2014 was developed and implemented. Brontosaurus mowing, forestry and prescribed burning have been conducted to implement management activities for maintenance and restoration of PPSOW habitat. Additionally some firebreak and dirt road maintenance has been conducted.

DMAVS/NHARNG plans to use prescribed fire on 98.8 acres of land to support 35.2 acres of PPSOW and 63.6 acres of DAOF. The proposed units for management on the ECTC are tied to natural community types, the location of site infrastructure (ECTC, RC, roads and utility ROW), are sized to limit smoke effects on adjacent activities (5.5 acres or less), and as much as possible use existing or former roads and trails as boundaries.

Table 9 ECTC Fire Management Units

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
PPSOW 1	PPSOW 1	-71.493679 43.19795	3.2	SH3 and TL2	258’	West	2	Mechanical and rx fire to restore PPSOW community and reduce wildfire risk.	See Table 9 for rare species protection strategy
PPSOW 2	PPSOW 2	-71.492474 43.198345	4.5	SH8	264’	West	3	Mechanical and rx fire to restore PPSOW community and reduce wildfire risk.	See Table 9 for rare species protection strategy
PPSOW 3	PPSOW 3	-71.490998 43.198238	2.2	SH4	264’	West	6	Mechanical and rx fire to restore PPSOW community and reduce wildfire risk.	See Table 9 for rare species protection strategy
PPSOW 4	PPSOW 4	-71.491619 43.199177	2.7	SH4	264’	Northwest	2	Mechanical and rx fire to restore PPSOW community and reduce wildfire risk.	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 9 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
PPSO 5	PPSOW 5	-71.488038 43.199831	2.7	SH8	263’	North	2	Mechanical and rx fire to restore PPSOW community and reduce wildfire risk.	See Table 5 for rare species protection strategy
PPSOW 6	PPSOW6	-71.493414 43.196784	3.6	TU2/TL6	260’	West	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy
PPSOW 7	PPSOW7	-71.491806 43.197347	2.5	SH8 SH3 SB2	260’	Southeast	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy
PPSOW 8	PPSOW8	-71.490474 43.196982	4.2	SH3 SB2	260’	South	1	Mechanical and rx fire to restore PPSOW community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
PPSOW 9	PPSOW9	-71.495765 43.199104	2.5	TU2/TL6	256’	Southwest	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy
PPSOW 10	PPSOW10	-71.495015 43.198386	3.3	SH3 SB2	256’	West	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
PPSOW 11	PPSOW11	-71.494803 43.197539	2.4	SH3 SB2	254’	Northwest	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy
PPSOW 12	PPSOW12	-71.494381 43.196645	1.4	SH3 SB2	250’	North-Northwest	2	Mechanical and rx fire to restore PPSOW community	See Table 5 for rare species protection strategy
DAOF 1	DAOF 1	-71.488136 43.199052	2.8	TL6	285’	Northeast	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 2	DAOF 2	-71.488206 43.198019	4.4	TL6	300’	Northeast	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 3	DAOF 3	-71.487974 43.19649	2.9	TL6	315’	Northwest	8	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 4	DAOF 4	-71.488979 43.196796	4.4	TL6	325’	West	14	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 5	DAOF 5	-71.488682 43.194986	5.0	TL6	280’	West	13	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 6	DAOF 6	-71.4897 43.193648	1.9	TL6	291’	West	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 7	DAOF 7	-71.491606 43.193331	3.5	TL6	290’	Northeast	4	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 8	DAOF 8	-71.492249 43.194272	2.7	TL6	282’	Northeast	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 9	DAOF 9	-71.492879 43.193619	2.6	TL6	316’	West	15	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 10	DAOF 10	-71.493354 43.194961	1.3	TL6	335’	West	8	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 11	DAOF 11	-71.492541 43.195935	2.1	TL6	267’	Southwest	2	Mechanical and rx fire to maintain DAOF community	See Table 5 for rare species protection strategy
DAOF 12	DAOF 12	-71.491719 43.196206	5.5	TL6	289	Southwest	10	Mechanical and rx fire to maintain DAOF community	See Table 5 for rare species protection strategy

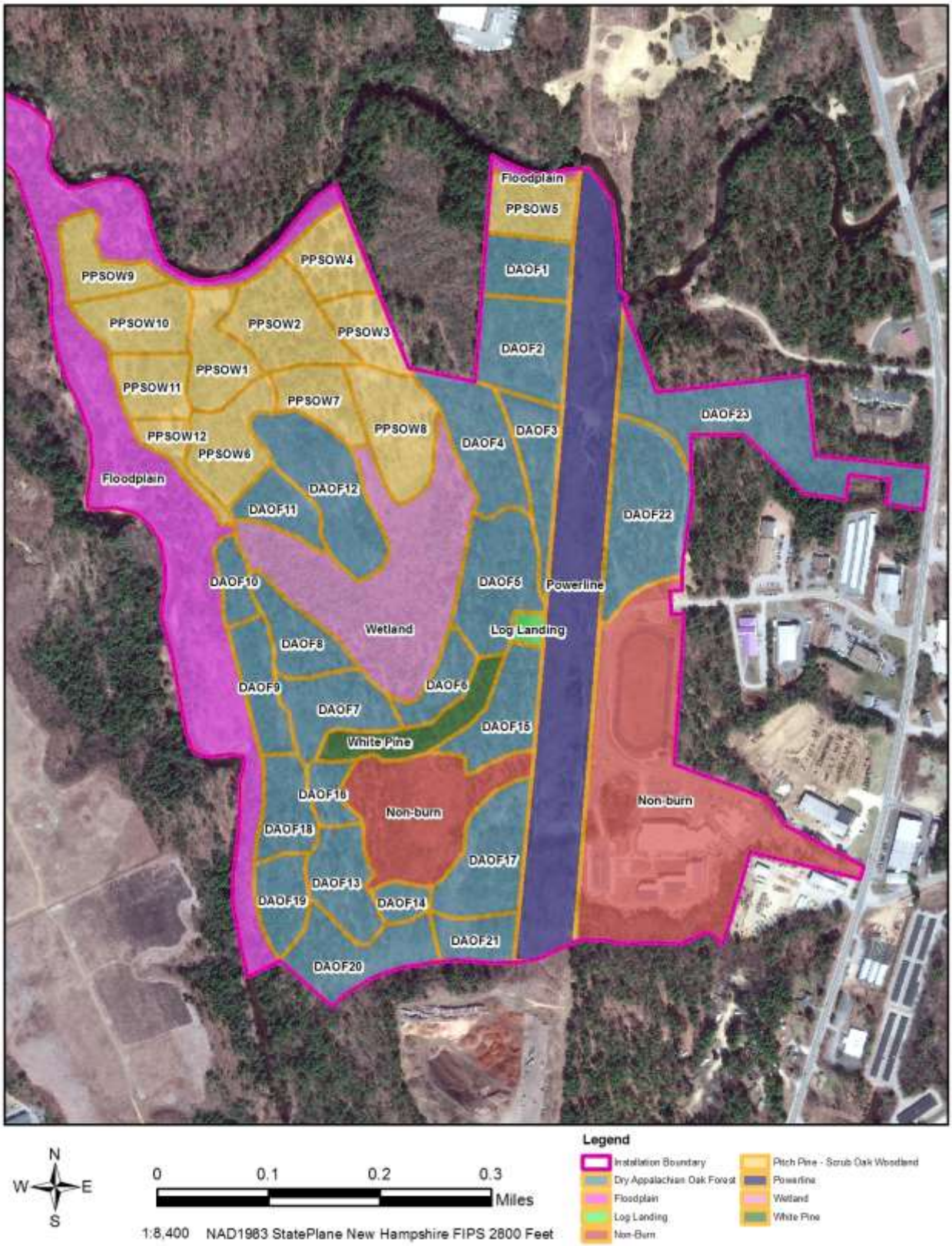
Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 13	DAOF 13	-71.491423 43.191076	3.2	TL6	312	Southwest	11	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 14	DAOF 14	-71.490403 43.190813	1.0	TL6	325	Southeast	1	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 15	DAOF 15	-71.488572 43.193263	3.5	TL6	253	West	9	Mechanical and rx fire to maintain DAOF community	See Table 5 for rare species protection strategy
DAOF 16	DAOF 16	-71.49167 43.19223	1.2	TL6	313	South	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 17	DAOF 17	-71.488849 43.191369	4.6	TL6	322	Southeast	6	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 18	DAOF 18	-71.492453 43.192012	2.6	TL6	264	West	18	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 19	DAOF 19	-71.492521 43.190841	2.3	TL6	264	West	18	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
DAOF 20	DAOF 20	-71.491208 43.190144	4.2	TL6	297	South	22	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF 21	DAOF 21	-71.48908 43.19034	1.9	TL6	303	South	12	Mechanical and rx fire to maintain DAOF community	Wellhead Protection Area, see Sections 2.8 and 5.6. See Table 5 for rare species protection strategy
DAOF22	DAOF22	-71.486069 43.19586	6.7	TL6	335	East	Not available	Mechanical Treatment only	Close proximity to school limits use of fire
DAOF23	DOAF23	-71.484095 43.19698	8.7	TL6	Not available	North	Not Available	Mechanical Treatment only	Close proximity to school limits use of fire
FLOOD-PLAIN	FLOOD-PLAIN	-71.495443 43.197151	30.2	TL2	Not Applicable	Not Applicable	Not Applicable	Suppression only	Not fire adapted
WETLAND	WETLAND	-71.490721 43.195074	14.5	TL2	Not Applicable	Not Applicable	Not Applicable	Suppression only	Wellhead Protection Area see Sections 2.8 and 5.6.

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	MGT Strategy	Comment
WHITE-PINE	WP	-71.490111 43.19311	3.6	TL8	Not Applicable	Not Applicable	Not Applicable	Suppression only	Wellhead Protection Area see Sections 2.8 and 5.6.
LOG LANDING	LL	-71.488127 43.194359	0.5	GS3	342	West	Not available	Mechanical and rx fire to maintain mixed grass and shrub	Possible use for Field Training
POWER-LINE	POWER-LINE	-71.487319 43.194944	21.5	GS3	Not Applicable	Not Applicable	Not Applicable	Suppression & Mechanical Treatment. Mowing for fuel break maintenance.	Utility Corridor limits use of RX Fire. Primary Maintenance by utility Company
EDWARD CROSS TRAINING COMPLEX	ECTC	-71.485722 43.192137	23.3	NON-Burnable & TL6	Not Applicable	Not Applicable	Not Applicable	Suppression & Mechanical treatment.	Primary Facility. Mostly Improved Grounds.
PEMBROKE READINESS Center	RC	-71.490041 43.191996	8.1	Non-Burnable	Not Applicable	Not Applicable	Not Applicable	Suppression only.	Primary Facility. Mostly Improved Grounds.

Map 10 ECTC Fire Management Units



SMR

Fuels on the State Military Reservation consist of grasses, shrubs and small stands of trees resulting from a habitat restoration. The majority of the burnable fuels are located on the eastern and southern portion of the SMR. The west side of the SMR consists mostly of non-burnable structures and parking lots. The fuels and natural community types on the SMR are a result of habitat restoration projects done to satisfy requirements for NHARNG to offset land developed during the AASF project. As such, the natural community and each burn unit on the SMR is very small and managed very specifically to satisfy mitigation of habitat loss associated with the Final Environmental Assessment For Replacement of the New Hampshire Army National Guard Army Aviation Support Facility Concord, New Hampshire Dec 2000 which states- "*Replace the loss of PPSOB natural community vegetation by permanently protecting and restoring approximately 15.2 acres of land on the SMR by prohibiting additional development, removing existing facilities and restoring PPSOB vegetation.*"

Fuels on the SMR will be managed to restore and maintain PPSOB vegetation without additionally impacting the mission capabilities of the SMR.

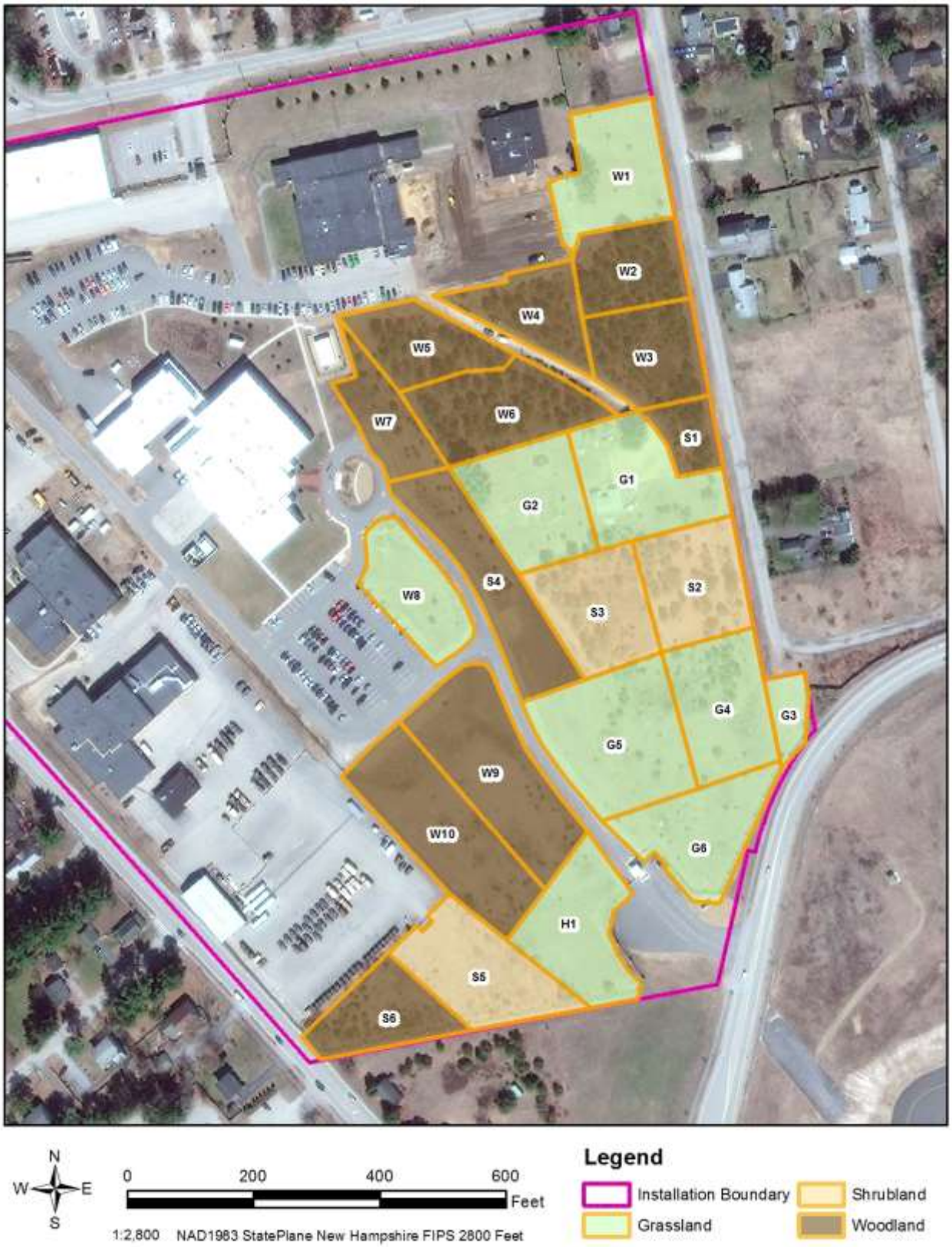
Table 10 SMR Fire Management Units

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	Management Strategy	Rationale	Special Considerations
Heath 1	H1	-71.510843 43.208455	0.67	GR3	340’	South	0-1	Mow/ Rx Burn – No burning within 50 feet of guard shack	Limit burning due to proximity to entrance gate	See Table 5 for species protection strategy
Wood 1	W 1	-71.510636 43.21174	0.6	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 2	W 2	-71.510539 43.211328	0.51	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 3	W 3	-71.510432 43.210953	0.59	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 4	W 4	-71.511112 43.211137	0.49	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 5	W 5	-71.511778 43.210996	0.51	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 6	W 6	-71.511314 43.210711	0.75	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 7	W 7	-71.511993 43.210676	0.53	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 8	W 8	-71.511821 43.209922	0.53	SH3	340’	South	0-1	Mow/ Rx Burn	Promote PPSOW community	See Table 5 for species protection strategy
Wood 9	W 9	-71.511344 43.20915	1.0	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Wood 10	W 10	-71.51165 43.208883	1.0	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	Management Strategy	Rationale	Special Considerations
Shrub 1	S 1	-71.510195 43.210603	0.23	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Shrub 2	S 2	-71.510158 43.209957	0.65	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Shrub 3	S 3	-71.510736 43.209847	0.67	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Shrub 4	S 4	-71.511371 43.209963	0.78	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Shrub 5	S 5	-71.511438 43.208272	0.76	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Shrub 6	S 6	-71.51202 43.208084	0.5	SH3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy
Grass 1	G 1	-71.51048 43.210393	0.78	GR3	340’	South	0-1	Mow/ Rx burn	Mow only within 50 feet of the KBB captive rearing building	See Table 6 for species protection strategy
Grass 2	G 2	-71.511126 43.21031	0.73	GR3	340’	South	0-1	Mow/ Rx burn	Promote native lupine	See Table 6 for species protection strategy
Grass 3	G 3	-71.509602 43.209395	0.17	GR3	340’	South	0-1	Mow	Promote PPSOW community	See Table 3 for rare species protection strategy
Grass 4	G 4	-71.509992 43.209422	0.72	GR3	340’	South	0-1	Mow/Rx Burn	Promote PPSOW community	See Table 6 for species protection strategy
Grass 5	G 5	-71.510622 43.209287	1.0	GR3	340’	South	0-1	Mow/ Rx burn	Promote PPSOW community	See Table 6 for species protection strategy

Unit ID	Map ID	Lat/Long NAD 83	Acres	Fuel Model	Elevation	Aspect	Percent Slope	Management Strategy	Rationale	Special Considerations
Grass 6	G 6	-71.510128 43.208881	0.78	GR3	340’	South	0-1	Mow	Mow only due to proximity to entrance gate and Regional Drive	See Table 6 for species protection strategy

Map 11 SMR Fire Management Units



4.5 Complexity Analysis

All DMAVS/NHARNG prescribed burns will be assigned a complexity rating of Low, Moderate, or High. This rating will be derived through completion of a Complexity Analysis Worksheet. This rating indicates the relative difficulty involved in implementation of the project. The worksheet guides manager's decisions on safety, resources, and other planning elements. There are several types of Complexity Analysis Worksheets available. The two recommended for use by the DMAVS/NHARNG are the New Hampshire Prescribed Fire Council's or the standard used by federal agencies- NWCG Prescribe Fire Complexity System Guide (PMS 424) and NWCG Prescribed Fire Summary and Final Complexity Worksheet (PMS 424-1). If federal partners will be acting in the role of burn plan preparer or Burn Boss, the NWCG complexity system will be used. If state partners will be plan preparers or Burn Boss the NH Prescribed Fire Council complexity analysis can be used.

NHPFC Complexity Analysis Worksheets can be referenced in Appendix A.

The most current versions of the NWCG PMS 424 and PMS 242-1 can be found at NWCG publications page: https://www.nwcg.gov/publications.

The most current version of the NHPFC Planning for Prescribed Burning in New Hampshire which includes the complexity analysis can be found at the NHPFC Publications page: https://extension.unh.edu/resource/new-hampshire-prescribed-fire-council-publications .

4.6 Prescriptions

Prescribed Fire Environmental Parameters: The following conditions have been developed, tested and used successfully by the NH Fish and Game Department to burn grassland and PPSOW habitat on the adjacent Concord Municipal Airport property. DMAVS/NHARNG will utilize the parameters as a baseline for developing specific burn Plan Parameters. Modification to these paramenter will be made to adjust for differing fuel model and specific burn objective and constraints that mya exist a a particular burn unit. Behave Plus5 fire behavior modeling software will be used to help establish the specific perscription parameters. Behave Plus5 modeling runs will be attached to each burn plan. .

Table 11 New Hampshire Fish and Game Environmental Parameters

Environmental Parameters	Acceptable Range
Scheduling	Spring, Fall
Fuel Model	NFFL Fuel Model: GR3 – Warm Season Grass
Temperature	50F-89 F
Relative Humidity (%)	26-65
Wind Speed (20' Forecasted)	5 mph-25 mph
Wind Speed (mid-flame)	2 mph-12 mph
1 Hr. Fuel Moisture (%)	6-12
10 Hr. Fuel Moisture (%)	NA
Rate of Spread (Ch/hr) Backing Fire	3.6 – 5.4
Flame Length (Ft) Backing Fire	2’ -2.7 ‘
Rate of Spread (Ch/hr) Head Fire	24 - 130
Flame Length (Ft) Head Fire	4.9 – 9.8

Environmental Parameters	Acceptable Range
Scheduling	Spring, Fall
Fuel Model	NFFL Fuel Model: SH3 – Mowed Pitch pine/scrub oak shrubland (dormant)
Temperature	50F-89 F
Relative Humidity (%)	26-65
Wind Speed (20' Forecasted)	5 mph-25 mph
Wind Speed (mid-flame)	2 mph-12 mph
1 Hr. Fuel Moisture (%)	6-12
10 Hr. Fuel Moisture (%)	6-20
Rate of Spread (Ch/hr) Backing Fire	0.2 – 0.6
Flame Length (Ft) Backing Fire	0.2 – 1.3
Rate of Spread (Ch/hr) Head Fire	2.2 – 15.0
Flame Length (Ft) Head Fire	1.8 – 4.1

Environmental Parameters	Acceptable Range
Scheduling	Spring, Fall, Summer
Fuel Model	NFFL Fuel Model: SH3 – Mowed Pitch pine/scrub oak shrubland (growing season)
Temperature	50F-89 F
Relative Humidity (%)	30-60
Wind Speed (20' Forecasted)	5 mph-25 mph
Wind Speed (mid-flame)	2 mph-12 mph
1 Hr. Fuel Moisture (%)	6-12
10 Hr. Fuel Moisture (%)	6-20
Rate of Spread (Ch/hr) Backing Fire	0.1 – 0.1
Flame Length (Ft) Backing Fire	0.3 – 0.5
Rate of Spread (Ch/hr) Head Fire	0.6 – 6.8
Flame Length (Ft) Head Fire	– 3.2

4.7 Smoke Management

Air Permitting

NHDES Regulations Env-A 1000 Prevention, Abatement, and Control of Open Source Air Pollution provides general requirements for open burning under Env-A 1001.04 and authorizes limited open burning under Env-A 1001.05. General burning requirement include: 1) burning in accordance with more stringent applicable state laws and regulations and local ordinances; 2) is authorized by an official having jurisdiction: and 3) includes burning only material allowed by law. These general requirements point RSA Chapter 227-L: Woodland Fire Control, CAR Res 5601 Fire Permits and any local ordinances that pertain to fire permits issued by the local fire warden or jointly issued by the local fire warden and the state FPB is needed when a permit is required.

Env 1001.05 authorizes limited open burning for the purposes of forestry and wildlife habitat improvement, and on-site burning by the land owner of brush and leaves provides the material originated onsite.

DMAVS/NHARNG prescribed burning program and any burning of brush is expected to meet the parameters in Env-A 1000 and only require an appropriate category fire permit. A Category IV Fire Permit is used for broadcast burns during day time hours of 0900-1700. Category III Permits would normally be used for burning brush (1700-0900). No permit is required to burn brush if the ground is covered with snow.

Air Quality

Air quality is regulated at the national level under the Clean Air Act of 1970 and its subsequent amendments. DMAVS/NHARNG fire management activities are subject to and must comply with all applicable Federal, state, and local air pollution control requirements, as specified by Section 118 of the Clean Air Act. The Clean Air Act requires state or local governments to monitor ambient levels of 6 federally regulated air pollutants called National Ambient Air Quality Standards (NAAQS). They are ozone, carbon monoxide, nitrogen dioxide, particulate matter, sulfur dioxide, and lead. Localities where these pollutants persistently exceed NAAQS are designated “non-attainment areas”. Air quality in the DMAVS/NHARNG region is part of the federally designated Merrimack Valley-Southern New Hampshire air quality region.

The air pollutant of most concern for fire/smoke management is particulate matter emissions less than or equal to 2.5 microns in diameter (PM 2.5), produced by smoke and dust. PM 2.5 especially can cause health problems and affect visibility in an area. Effects are measured using NAAQS. Adverse effects can result if the standards are exceeded by the proposed activities. The current Federal and State standards for PM 2.5 is:

The concentration of PM 2.5 must not exceed 35 (µg/m^3) over a 24 hour period averaged over 3 years. Additionally the annual mean, averaged over 3 years, of PM 2.5 concentrations must not exceed 12 (µg/m3).

Particulate Matter 2.5 is a concern because the small size of the particles allow them to enter the lungs and cause health problems. Particulates also decrease visibility and contribute to haze. Common sources of these particles include vehicle combustion, power plants, wood stove smoke, prescribed fires and wildfires. The nearest PM 2.5 monitoring sites to the SMR is on Hazen Drive in Concord. Baseline levels of PM 2.5 at these sites are below10 ug/m3 annual average (NH Ambient Air Quality Monitoring Program 2012). Table 16 Show Air Quality Index (AQI) and potential health effects from various level of PM 2.5. The AQI is also used by Blue Sky and VSmoke Web Smoke modeling programs for estimating smoke plume PM 2.5 concentrations and distances.

Table 12 PM 2.5 Concentrations in Relation to Health and Visibility Concerns

PM 2.5 24-hr. AVG Concentration (μ/m^3)	PM 2.5 1hr. AVG Concentration (μ/m^3)	AQI Values	Visibility (miles)	Levels of Health Concern	Cautionary Statements
0.0-12	0.0-40.0	0 -50	>10	Good	None
12.1-35.4	40.1-80.0	51-100	5.1-10.0	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion
35.5-55.4	80.1-175.0	101-150	3.1-5.0	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion
55.5-150.4	175.1-300.0	151-200	1.6-3.0	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion
150.5-250.4	300.1-500	201-300	1.0-1.5	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity. Everyone else should avoid prolonged or heavy exertion.
250.5+	500+	301-500	<1.0	Hazardous	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.

Smoke Sensitive Populations

Most healthy adults recover quickly from smoke exposure but some segments of the population may be more susceptible to health effects from smoke. Smoke Sensitive Populations are categorized in the document *Wildfire Smoke, A Guide for Public Health Officials July 2008* as:

- Individuals with asthma, and other respiratory diseases
- Individuals with cardiovascular disease
- The elderly & children

Analysis of the effects of prescribed burning on the SMR and ECTC on sensitive populations focused on places where potential smoke sensitive populations were non mobile and most likely to be affected by smoke in a worst case scenario. These areas include hospitals, nursing homes, schools, and an airport. This plan has been developed to minimize exposure of smoke sensitive population from prescribed burning and wildfires (see Emissions Modeling in in Map 11, Map 12 and Map 13).

Existing Conditions

Regional winds move from west to east, and local winds are dominated by river and valley dynamics interacting with large-scale atmospheric movements. Climate in the project area is characterized by warm humid summers, with average high temperatures in the mid 70's F and lows in the 50's; and cold, wet winters with average low temps in the teens and highs in the 30's F. Average monthly precipitation is 3.2 inches. Monthly snowfall amounts average 10-18 inches during the winter. Average annual precipitation statewide is around 40 inches. Humidity is high year round, averages ranging from 50 to 80% with the highest during the late summer. Lowest humidity occurs during the spring and winter months. Wind speeds are highest during the spring and lowest in late summer. Source-http://www.city-data.com/city/Concord-New-Hampshire.html

During the spring and fall prescribed burn seasons, the area often experiences dry, windy days with good airflow and rapid recharge of the air shed.

Current air quality in the project area is considered to be good. Air quality monitoring systems maintained by the state of NH indicate that of the 6 criteria pollutants (NAAQS). A Portion of Central NH is designated as a Non-Attainment Area for SO2, including the Town of Pembroke. A revised State Implementation Plan is being submitted by the State of New Hampshire to US Environmental Protection Agency to re designate the area as in attainment as of October 2018 and providing a plan to maintaining attainment.

Existing emissions in the air or air pollution that occurs in the air shed are mostly related to regional and industrial sources (Merrimack Station power plant, Bow, NH). Local pollution, such as vehicle emissions and dust from roads is minor. In the winter, woodstoves contribute particulates and carbon monoxide to the air. Periodically, large

wildfires in Canada or the Lake States contribute particulates. Dust from roads contributes particulates. On occasion, ground-level ozone in the area exceeds air quality standards. This occurs mostly in summer months due to weather and air flow, and is not frequent enough for the area to be categorized as a nonattainment area.

Smoke Management Best Management Practices

A number of best management practices can be employed during prescribed burns to minimize smoke to surrounding areas and particularly smoke sensitive receptors.

Smoke modeling programs such as Blue Sky Playground and VSmoke Web were used to estimate smoke concentrations and dispersion distances. Information from these programs was used to size burn units to contain as much of the most concentrated smoke on the NHARNG properties as possible or other undeveloped/populated lands.

Establishing burn plan prescriptions that specify wind directions to be used when burning that will send smoke away from smoke sensitive receptors and avoid the most populated areas near the burn locations.

Use of firing techniques that maximize flaming consumption and minimize smolder will minimize the generation of smoke.

The DMAVS/NHARNG will check current and expected air quality prior to burning and ensure that air quality is not already compromised on the day of the burn.

The DMAVS/NHARNG will ensure that adequate mixing height of 1650 ft is present during the burning period to allow smoke to rise and move away from the area facilitating dispersal.

Air Quality Impacts NHNGTS

The DMAVS/NHARNG plans to use prescribed fire on up to 15 acres of open grassland improve and maintain the grassland for wildlife and field training. Although it is expected that only ¼ to 1/3 of that area will be burned each year.

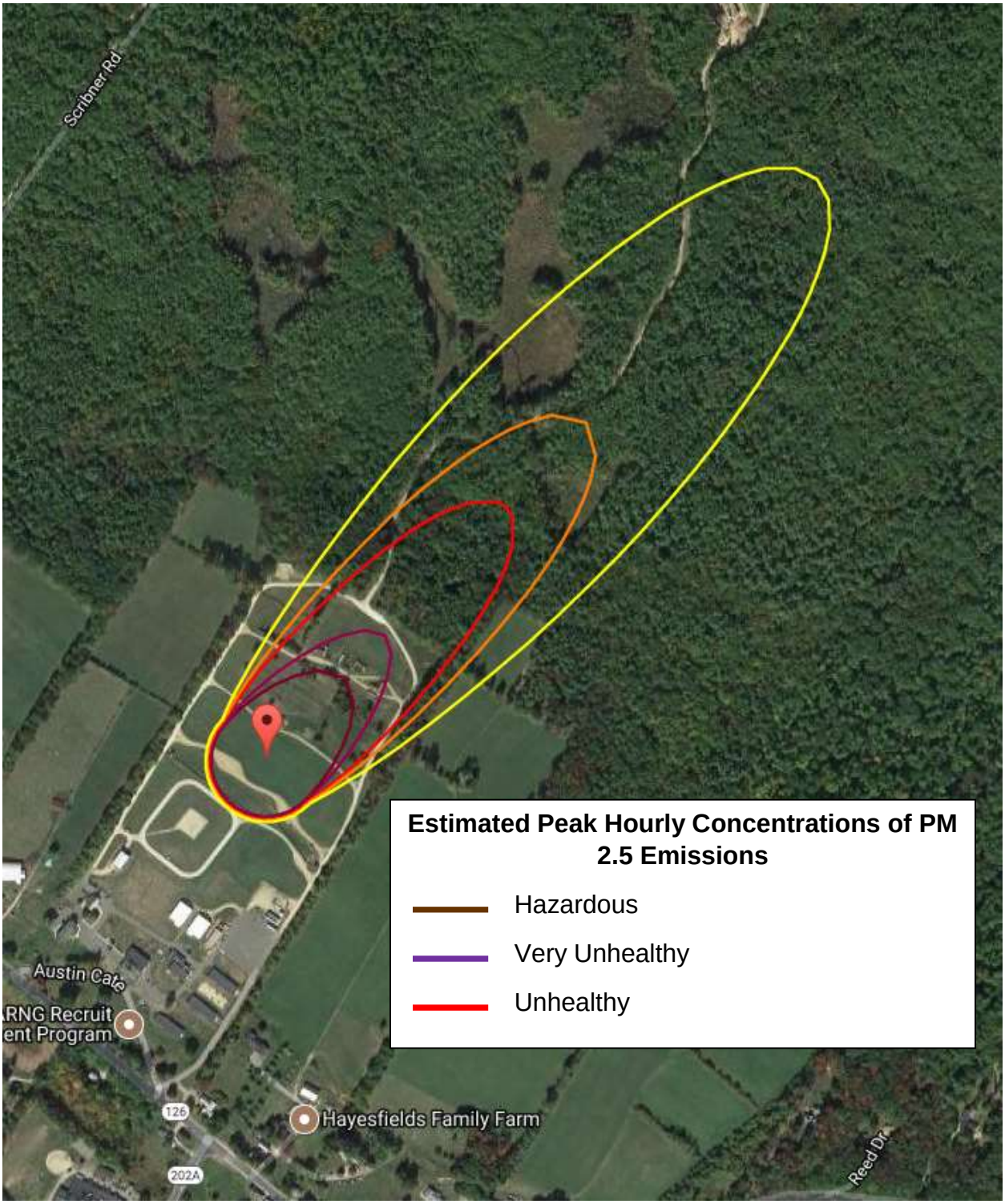
Smoke receptors near the NHNGTS include the Village of Center Strafford immediately south of the NHNGTS and rural residential areas along Route 202A, 126 and Scribner Road. Specific smoke sensitive facilities include the Library 0.2 mile (southeast), the Strafford Central School 0.3 miles (south west), Strafford Town Hall, U.S. Post Office 0.2 mile (west) and Third Baptist Church 0.4 miles (South) of the Burn units. The majority of the areas to the north and east of the NHNGTS is undeveloped rural forest.

To estimate the direct effects of smoke on identified critical smoke sensitive receptors, V Smoke Web smoke modeling analysis program was run for NHNGTS Unit G2 (4.6 ac). V Smoke Web produces a satellite map showing estimated peak hourly

concentrations of PM 2.5 (MAP 11). Smoke effects are shown by depicting a modeled smoke plume from fire origin and plume relation to the AQI values shown in Table 15.

Based on the location of the smoke sensitive receptors west and south of the site, prescribed burning will be conducted with winds from the south, southwest, west and northwest. This will disperse the smoke in undeveloped areas.

Map 12 Estimated Peak Hourly Concentrations of PM 2.5 Emissions SW Wind, NHNGTS Unit G2



It is understood at the federal and state levels that fire is an important and necessary element in land based ecosystems and that emissions from properly managed prescribed fires are preferable to emissions from uncontrolled wildfires. Public outreach to local communities and fire departments that may be less cognizant of the benefits of long term fire management should be considered as part of this fire management plan.

Air Quality Impacts ECTC

The DMAVS/NHARNG plans to use prescribed fire on up to 99 acres of habitat to improve and maintain natural communities and reduce the fuel loads that may contribute to wildfire growth on the ECTC. It is expected that a maximum of 10-15 acres will be burned each year.

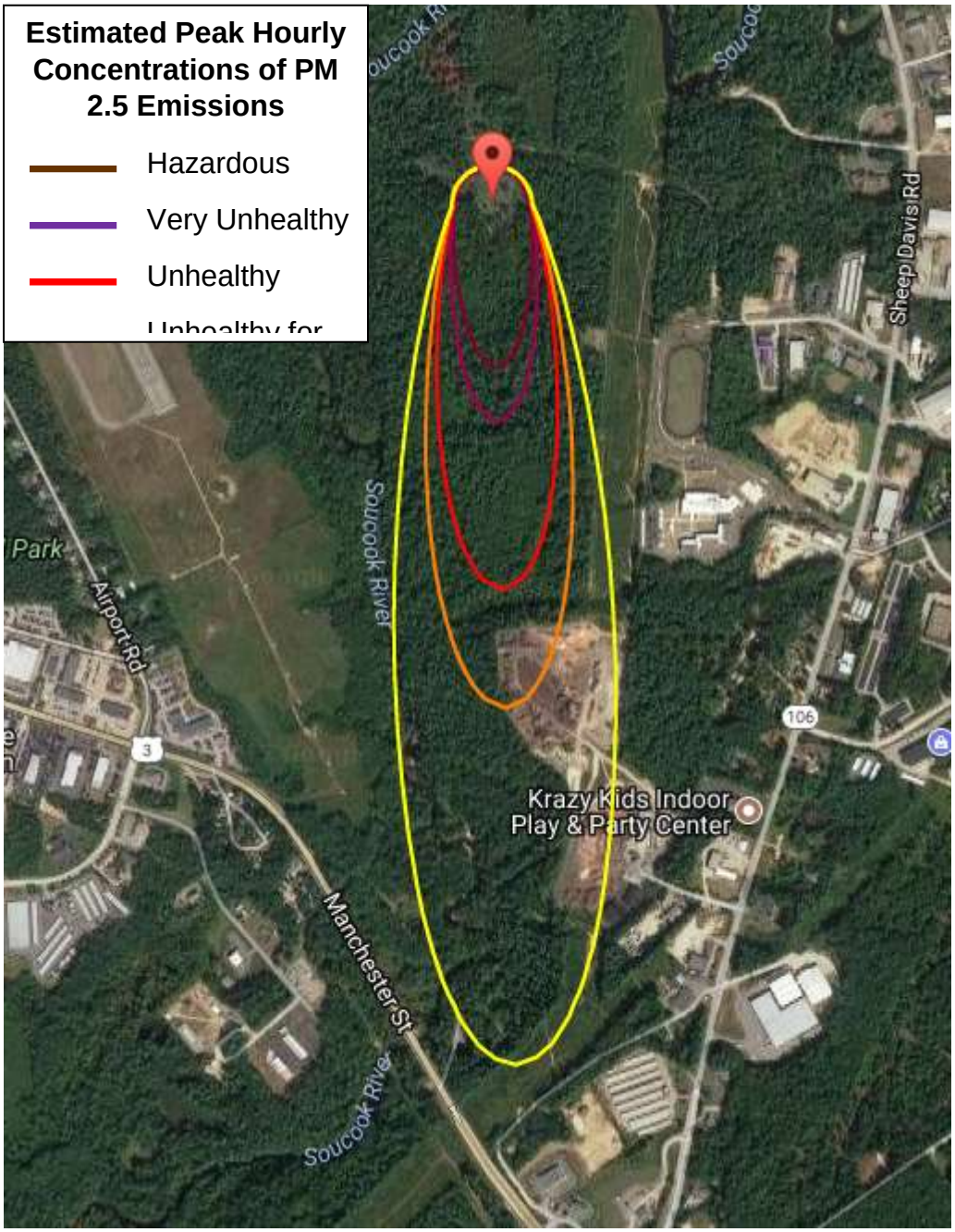
Smoke receptors near the project area include personnel working on the ECTC, industrial and residential areas in the City of Concord north and west of the site, commercial and light industrial areas east and south of the site in the Town of Pembroke as well as rural residential areas further east in Pembroke. See Map 4 Wildland Urban interface for the ECTC shows general land use patterns for Pembroke and Zoning for Concord. Specific smoke-sensitive receptors near the ECTC include the Strong Foundations Charter School 0.1 mile east, a residential area 0.1 miles southeast, Crazy Kids play center 0.2 miles south east, the United Church of Christ 0.25 mile east, Eastern Analytical Laboratory 0.6 miles north and the Early Enrichment Center and Flipz Gym 0.75 Mile north of the ECTC. No hospitals or nursing homes are close enough to be affected by smoke from the ECTC. The Concord Municipal Airport is directly to the north and east of the ECTC and may be affected by smoke if burning with an east or south wind.

The short distance from these areas to the burn units will restrict the burning conditions to periods when wind, weather, and fuels cause smoke to quickly disperse into the atmosphere.

Burn units on the ECTC have been limited to 5.5 acres with many units being in the 2-4 acre range. While more than one unit might be burned in one day, short interludes between burning different units will allow smoke to disperse.

To estimate smoke concentrations and dispersal distances a smoke modeling analysis program was run for ECTC unit (PPSOW8 4.0 ac) using V Smoke Web. V Smoke Web produces a satellite map showing estimated peak hourly concentrations of PM 2.5 (See MAP 12). Smoke effects are shown by plume distance from fire origin and plume relation to the AQI values shown in Table 15.

Map 13 Estimated Peak Hourly Concentrations of PM 2.5 Emissions N Wind, Unit PPSOW8



To minimize smoke effects burn units on the ECTC burn units have been designed to be 5.5 acres or less with most units being in the 2-4 acres range. Burn units can be further subdivided into smaller units if necessary.

Burns on the ECTC can be implemented with multiple wind directions. Preferred wind direction include north to northwest and west to south west. These wind directions will minimize smoke on sensitive receptors. The Strong Foundations School is east of the ECTC and burning with wind sending smoke directly at the school while it is in session will be avoided. Even with good planning the school and the ECTC may experience smoke for short periods of time. All personnel working on the ECTC need to be informed of the burn. Neighborhoods to the north, south and east of the ECTC should be notified. Warning signs should be placed along Riverwood Drive, Route 106/Sheep Davis Rd and Route 3/Pembroke Street. The Concord Municipal Airport will be informed of the burn.

Air Quality Impacts SMR

The DMAVS/NHARNG plans to use prescribed fire on up to 15 acres of habitat to improve and maintain the globally rare PPSOW natural community, habitat for the Karner blue butterfly and reduce the fuel loads that may contribute to wildfire growth on the SMR. A Maximum of 3 acres will be burned in each year. The fire return intervals (the average years between fires necessary to maintain a specific habitat type) for PPSOW communities range from 3 to 20 years for shrub and grassland component that support KBB is appropriate with the SMR.

Sensitive receptors near the project area include personnel working on the SMR, residential and commercial areas of Concord immediately north, west, southwest and east of the SMR. The Concord Municipal Airport (CMA) is south and south east of the SMR and while smoke sensitive is the least populated area around the SMR. See Map 3 SMR Wildland Urban Interface which depicts Concord Zoning District. Specific smoke sensitive receptors near the SMR include Merrimack Valley Daycare Services <0.1 mile west, Riverbend Community Mental Health Center 0.15 miles north, Keach Park 0.2 miles northeast, Concord Community Center 0.3 mile northeast, the Concord Christian Academy 0.4 mile east, Sylvan Learning Center 0.5 miles east, the Children's Place Daycare 0.5 miles north and the Early Enrichment Center and Flipz Gym 0.6 mile east of the SMR. No hospitals or nursing homes are close enough to be affected by smoke from the SMR.

The short distance from SMR burn units to these densely populated residential and commercial areas of the Concord Heights and the specific smoke sensitive facilities will restrict burning conditions to periods when wind, weather, and fuels cause smoke to quickly disperse into the atmosphere away from these populations. In addition limiting the size and duration of each prescribed burn will minimize potential impact to smoke sensitive receptors.

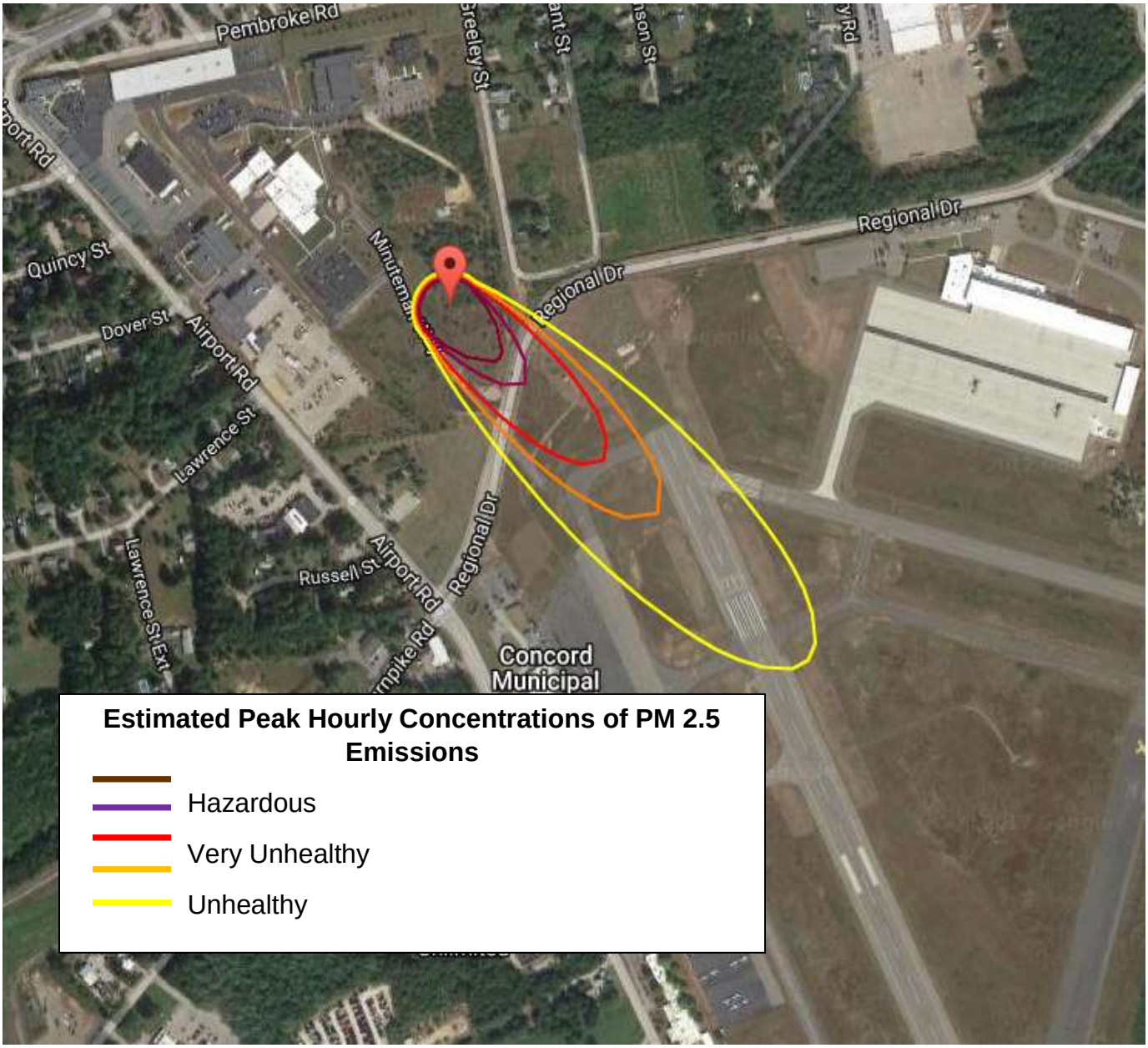
The Concord Municipal Airport is directly to the south of the SMR. A long history of prescribed burning on the Concord Municipal Airport exists. Coordination with the Airport including requesting a Notice to Airmen (NOTAM) regarding prescribed burning is standard practice. Periods of time when airport use is particularly high such as around National Association of Stock Car Auto Racing (NASCAR) events at the Loudon International Speedway are avoided.

Based on the concentration of activities to the west, north and east, the minimal population on the CMA and its history of prescribed burning, prescribed burning on the SMR will be restricted to days when winds are out of the north, northwest, and west and smoke is expected to disperse over the CMA.

The direct effects of prescribed burning in the project area would be the release of particulate matter (PM 2.5), carbon monoxide, hydrocarbons, and nitrogen oxides during combustion. Ignition of each prescribed burn units on the SMR land is estimated to be 1 hour or less. During this period, the majority of burnable fuels will be consumed. Smoke may be seen in the immediate area during this period but will not be sufficient to impact sensitive populations. Adverse effects of smoke produced by prescribed burning include reduced visibility due to haze and exposure to the public and fire crew to smoke and carbon monoxide. The pollutant of most concern is PM 2.5 which in high concentrations can have adverse impacts on people's health. The Air Quality Index (AQI) charts the level of health concerns and visibility associated with particulate concentrations.

To estimate the direct effects of smoke on identified critical smoke sensitive receptors, a smoke modeling analysis program was run for the largest SMR unit (G5 1.0 ac) using V Smoke Web. V Smoke Web produces a satellite map showing estimated peak hourly concentrations of PM 2.5 (See Map 13). Smoke effects are shown by plume distance from fire origin and plume relation to the AQI values shown in Table 15. Smoke is expected to be visible for approximately 0.25 miles.

Map 14 Estimated Peak Hourly Concentrations of PM 2.5 Emissions NW Wind, Unit G5



To minimize smoke effects burn units on the SMR have been designed to be 1.0 acres or less. Burns on the SMR should be conducted with a west, northwest or north wind which will send smoke towards the relatively unpopulated Concord Municipal Airport. Burn units can be further subdivided into smaller units if necessary. These measures will minimize smoke impacts to the commercial area north of the SMR along Loudon Road and to the residential areas east and west of the SMR. All personnel working on the SMR need to be informed of the burn. Neighborhoods to the east and west of the

SMR should be notified. Warning signs should be placed along Airport Rd. and Regional Drive. The Concord Municipal Airport will be informed of the burn.

Chapter 5 - Safety

5.1 Training

The DMAVS/NHARNG will utilize established wildland and prescribed fire training available from multiple sources including NHFPB, White Mountain National Forest, New Hampshire Prescribed Fire Council (NHPFC), National Guard Bureau, other local regional or national organizations. Most formal training will be National Wildfire Coordinating Group (NWCG) courses designed to meet training needs for position qualification.

The DMAVS/NHARNG is a member of the NHPFC and will also seek certification in NHPFC prescribed fire positions. DMAVS/NHARNG will recognize both NWCG and NHPFC standards as qualifying individuals for their positions. NHPFC or National Wildfire Coordinating Group (NWCG) task books will be initiated and completed as part of the process.

As a member of the NHPFC DMAVS/NHARNG staff can participate in prescribed burns on other council member's lands to maintain currency, qualifications and as a trainee. DMAVS/NHARNG personnel will utilize these opportunities to the extent possible to work on position task books. DMAVS/NHARNG may also seek other wildfire trainee experience to fulfill wildfire specific tasks in position task books.

Further links to training sites include:
National Wildfire Coordinating Group Training Information
http://training.nwcg.gov/
https://www.nwcg.gov/publications/training-courses
https://nationalfiretraining.nwcg.gov/

NWCG and NHPFC prescribed fire positions and required trainings are listed in **Error! Reference source not found.** and Table 14. As use of training lands increases, consideration should be given to training permanent staff at the ECTC and NHNGTS to NWCG Firefighter Type 2 level to provide some level of knowledge and immediate response capability.

Table 13 NWCG Prescribed Fire Position Descriptions

NWCG Fire Position	Required Training NWCG	Required Experience
Firefighter Type 2 (FFT2)	Introduction to ICS (I-100) Human Factors in the Wildland Fire Service (L-180) Firefighter Training (S-130) Introduction to Wildland Fire Behavior (S-190) NIMS: An Introduction (IS-700)	None
Firefighter Type 1 (FFT1)	Annual Fireline Safety Refresher (RT-130) Firefighter Type 1 (S-131) Look Up, Look Down, Look Around (S-133)	Satisfactory performance as FFT2
Rx Fire Burn Boss Type 3 (RxB3)	Required: S-290 Intermediate Wildland Fire Behavior Suggested: S-219 Firing Operations	Incident Commander, Type 5 or FFT1 and Satisfactory position performance as a Prescribed Fire Burn Boss Type 3
Rx Fire Burn Boss Type 2 (RxB2)	Annual Fireline Safety Refresher (RT-130) Introduction to Wildland Fire Behavior Calculations (S-390)	Satisfactory performance as a Firing Boss, Single Resource (FIRB) Satisfactory performance as an Incident Commander Type 4 (ICT4) Successful position performance as a Prescribed Fire Burn Boss Type 2 (RXB2) on a prescribed fire incident
Fire Effects Monitor (FEMO)	Annual Fireline Safety Refresher (RT-130) Intermediate Wildland Fire Behavior (S-290)	Satisfactory performance as FFT2/Basic Prescribed Firefighter

Table 14 NHFPC Fire Positions

NHPFC Rx Fire Position	Required Training NHPFC	Required Experience
Basic Prescribed Firefighter (RXFF1)	Introduction to ICS (I-100) Human Factors in the Wildland Fire Service (L-180) Firefighter Training (S-130) Introduction to Wildland Fire Behavior (S-190)	None
Advanced Prescribed Firefighter (RXFF2)	Annual Fireline Safety Refresher (RT-130) Fire Fighter Type I (S-131) Look Up, Look Down, Look Around (S-133) and either Portable Pumps and Water Use (S-211) or Engine Boss (S-231)	RXFF1
Rx Fire Burn Boss Type 3 (NHRXB3)	Annual Fireline Safety Refresher (RT-130) Ignition Operations (S-234) Intermediate Fire Behavior (S-290). Optional Training: Crew Boss (S-230).	RXFF2 OR FFT1
Rx Fire Burn Boss Type 2 (NHRXB2)	Annual Fireline Safety Refresher (RT-130) Basic ICS (I-200) Crew Boss (S-230). Optional Training: RX-301 Prescribed Fire Implementation RX-341 Prescribed Fire Burn Plan Preparation RX-310 Introduction to Fire Effects	NHRXB3
Fire Effects Monitor	Recommended Training: Intermediate Fire Behavior (S-290).	RXFF1
Prescribed Fire Burn Planner	Recommended Training: NH Burn Boss 3 or RX-341 and RX-301.	None

The following links provide more information on Qualification Systems and Task books:
http://www.nwcg.gov/pms/docs/docs.htm
http://www.nwcg.gov/pms/taskbook/taskbook.htm

5.2 Physical Fitness

DMAVS/NHARNG will follow NWCG or NHPFC physical fitness standards for wildfire and prescribed fire. Baseline test will be the work capacity test (WCT). Personnel engaged in fire suppression activities are required to pass the arduous level WCT (3 mile hike in 45 minutes with 45 lb. pack). Personnel engaged in prescribed fire activities are required to pass the moderate WCT (2 mile hike in 30 minutes with 25 lb. pack). DMAVS/NHARNG may administer their own WCT or attend a WCT given by partners and cooperators.

For more information on Work Capacity Test requirements see the following link: https://www.fs.fed.us/managing-land/fire/safety/wct

5.3 Certification Standards and Records

DMAVS/NHARNG is utilizing the FPB for initiating and certifying individuals for their positions as well as maintaining qualification and performance records for DMAVS state employees. The WFPM may assume responsibility for initiating and certifying position qualification in the future should the FPB be unable to continue with this role or seek another sponsoring agency. The WFPM as well as each individual will maintain training, qualification and performance records. Wildland fire qualifications for NHARNG (Federal) personnel are currently not maintained by the WFPM. Individuals should provide training and qualification to the WFPM and their respective human resources office.

5.4 Personnel Protective Equipment

All DMAVS and NHARNG personnel engaging in fire suppression or prescribed fire activities will be issued and will carry personal protective equipment (PPE) that meets the minimum standards identified by the National Fire Protection Association (NFPA) and the NWCG. Minimum standards are:

- Flame-resistant Nomex pants and shirts
- Eight-inch (minimum) leather boots with Vibram sole
- Hard hat
- Gloves
- Eye and ear protection (as needed)
- Fire shelter with carrying case and harness

5.5 Communications

DMAVS does not have a dispatch center. During a wildfire or prescribed fire the Joint Operation Center (JOC) will act as dispatch for National Guard personnel. JOC will inform NHNG leadership of wildfire when notified.

There is currently no plan for a NHARNG fire department or fire staff. Suppression will be handled by town and state forces as described in Section 3.4.

If fires occur on the ECTC, SMR, or NHNGTS the first communication will be to notify the appropriate Fire Department through the 911 system. The next contact will be the JOC who would then notify the Wildland Fire Program Manager and leadership.

The DMAVS/NHARNG fire program has 4 Kenwood handheld radios for field communications. Radios are programmed with state inter-operable frequencies.

5.6 Specific Standard Operating Procedures

Public and personnel safety is a core value in both the US Army and the Wildland Fire Community. All wildfire suppression action as well as fuels reduction and prescribed fire projects will adhere to safety standards outlined by the US Army and the National Wildfire Coordinating Group. Furthermore, it is important that all personnel who assist DMAVS/NHARNG in wildland fire management operations, whether they be Military, DOD, Civilian Personnel, Contractor or Mutual Aid Responders are aware of the unique hazards present on military training installations such as DMAVS/NHARNG.

Unexploded Ordnance (UXO): There are no known areas on the SMR that contain UXOs however, caution should always be observed when working on military lands.

The ECTC does not contain military origin UXOs but the property was and still is used for hunting and target practice by the public. Small arms ammunition is most likely present on the ECTC.

The NHNGTS uses pyrotechnics and ammunition during trainings. Use of pyrotechnics and ammunition on the NHNGTS is well regulated by Range Control and it is unlikely to be encountered. The following link contains images of pyrotechnics and ammunition that may be encountered on NHNGTS lands:

http://www.denix.osd.mil/uxo/UXOPhotos/

- If you see UXO, stop and do not move closer.
- Isolate and clearly mark the area.
- Deny entry to others.
- Never transmit radio frequencies near UXO.
- Never remove anything near UXO.

- Never touch, move, or disturb UXO.
- Keep a minimum of 1000 feet away from areas on fire that contain suspected UXO.
- Report discovery of UXO to your immediate supervisor.

Eversource Power Line: ECTC is bisected by an Eversource power line right-of-way. 24 hour contact number for Eversource is: 1-800-662-7764. Personnel responding to a fire along this corridor should observe the following standard operating procedures when working around power lines:

- Don't operate heavy equipment under power lines.
- Don't use right-of-ways as a jump or cargo drop spot.
- Don't drive with long antennas under power lines.
- Don't stand near power lines during retardant drops.
- Don't park under power lines. The magnetic field around energized power lines can induce an electrical charge in ungrounded vehicles or equipment. This charge can shock anyone who touches the vehicle.
- Don't apply straight stream to power lines.
- All personnel should be cautioned that smoke may become charged and conduct the electrical current. In addition, deactivated transmission and distribution lines may continue to pose a hazard due to induction.
- If power lines fall on your vehicle, DON'T leave the vehicle until the power company arrives. If the vehicle is on fire or fire is near, jump clear, don't hang on, keep feet together, and bunny hop away.

Gas Pipeline: An underground gas pipeline owned by National Grid follows the power line corridor. Contact number for National Grid is: 1-800-833-4200. Prior to any fire management activities at ECTC adjacent to the natural gas right-of-way DMAVS/NHARNG should contact National Grid and request that gas pipeline location be identified with permanent markers.

5.7 Community Outreach

An effort should be made to engage the local communities in the necessity of base operations, and the value of fuel reductions activities to reduce smoke impact and enhance wildlife habitat. This effort should be coordinated with partners including the NHPFC, NHF&G, WMNF, NHDNCR, NHDES and Concord, Pembroke, and Strafford Fire Department. One clear partner to integrate outreach messages with is the NHF&G, which currently conducts prescribed burns on the Concord Municipal Airport adjacent to DMAVS/NHARNG lands. The DMAVS/NHARNG and NH F&G have similar objectives and already assist each other on projects.

For more information on developing a Community Outreach Plan use the following link:

http://www.nifc.gov/PIO_bb/Background/NWCG-WFEWT-CommPlanning.pdf

Chapter 6 - Resources

6.1 Funding Sources

Army National Guard Environmental funds are used to write the IWFMP and provide for ecosystem and endangered species management. Army National Guard Improved and Unimproved Grounds Maintenance Funding would be used for suppression and projects related to suppression (fuels reduction, mowing firebreaks). Funding for training is included in the Environmental and the Fire and Emergency Services accounts.

6.2 Equipment: Existing and Needed

NHARNG/DMAVS has been purchasing wildland fire equipment and supplies to support the prescribed burn programs at the SMR and ECTC over the last several years. While most of the portable equipment, tools and supplies have been procured to execute prescribed burns at an individual location, some shortages of equipment still exist.

There are 2 caches of fire equipment easily available for prescribed fire and suppression needs. The primary cache is owned by DMAVS and is located in Bay A, Building D on the SMR. There is a second cache located in the shed next to KBB captive rearing facility (Building ST 1) also on the SMR. This cache of equipment is owned by the NHFG, but could be used with permission for a prescribed burn or in an emergency. Inventories of these caches are locate in Appendix H.

The DMAVS owns a Type 7 Engine: Polaris Ranger 6X6 which is equipped with a Cascade Fire Equipment slip on pump unit Model 24052 with 50 gallons of water storage, 100 foot hose reel and pump capable of producing 38 GPM at 100 PSI. The Type 7 engine has storage for hand tools, 100 feet of extra hose, adapters, drip torches and back pack pumps. The type 7 engine is located at the SMR and will be transported to the ECTC or the NHNGTS in preparation for prescribed burns.

NHARNG/DMAVS has no type 6 engines. Additionally all the equipment is located at the State Military Reservation. There is currently no space at the ECTC or NGTS to maintain a cache of equipment and supplies. A request to the NGB for type two 6 engines is expected to be filled in 2021. Additionally a FY21 funding request to construct a building at the ECTC to store the engines is being forwarded to the NGB. A location and for temporary storage of 1 of the engines and a cache of supplies at the NGTS is needed. Separate caches at each site is needed to ensure availability of equipment in the event of a wildfire. Once separate location for each site is established a separate equipment inventory a will be developed for each site. The inventories will be added to Appendix H.

Each year DMAVS/NHARNG will inventory equipment and supplies and make determination as to the need for additional equipment to support all three sites. Currently the expectation is that partners like the White Mountain National Forest, New Hampshire Division of Forests and Lands FPB, New Hampshire Fish and Game and

local fire departments and contractors may be able to provide the additional supplies needed for fire management activities beyond what is available. Particularly WMNF or FPB would supply Type 6 engines or engines of better capability to meet the needs of particular prescribed burns. No organic engines are available for Wildland Fire Suppression.

As DMAVS/NHARNG's fire management program develops it may become cost effective for DMAVS/NHARNG to directly handle the prescribed fire burn boss duties.

6.3 Personnel

This plan is being developed with the assumption that DMAVS employees in the Environmental Office will be the primary organic employee resource for implementing fire management activities that require position certification. DMAVS employees will be supplemented with personnel from other organizations through existing agreements or future agreements to be developed. Use of other NHARNG personnel (Federal Technicians, AGR, etc.) may be used if determined appropriate.

DMAVS/NHARNG personnel engaged in fire management will be qualified for their positions and meet physical fitness standards according to requirements established in the National Interagency Incident Management System: Wildland Fire Qualification System Guide, PMS 310-1 (National Wildfire Coordinating Group, October 2017 or current version) or in the New Hampshire Prescribed Fire Council (NHPFC) publication *Planning for Prescribed Burning in New Hampshire: Minimum Recommended Standards for Planning and Implementing Prescribed Burns. August 2012*.

Currently the Wildland Fire Program Manager (WFPM) is qualified as NWCG Firefighter Type 1 (FFT1), NHPFC Advance Prescribed Firefighter (NHFF2), NHPFC Prescribed Fire Burn Boss Type 3 (NHRXB3) and NHPFC Prescribed Burn Planner (RXP). The WFPM has an initiated NHPFC Burn Boss Type 2 task book open and has requested NWCG Firing Boss and Fire Effects Monitor task books to be initiated by the FPB. The Conservation Specialist are qualified as a NWCG Firefighter Type 2 (FFT2). There is an additional permanent staff member qualified as a NHPFC Basic Prescribed Firefighter (RXFF1) and NWCG FFT2. As DMAVS/NHARNG's fire management program develops it is recommended that FFT2 be a hiring consideration for temporary employees and offered to permanent employees as career development.

A standard burn crew configuration for the SMR units should be a minimum of 6 people. The small size of the units and availability of water and access will make operations relatively simple.

A minimum of 11 people are recommended for ECTC burn units as there is more complexity involved in terrain, fuels, and access.

6.4 Interagency Cooperation and Mutual Aid Agreements

DMAVS is a participating agency in the Prescribed Fire Memorandum of Understanding Between Members of the New Hampshire Prescribed Fire Council (NHPFC) dated 2019. DMAVS also participated in an agreement with the NHPFC from 2013-2018. The MOU between the NHPFC members allow parties to share resources, participate in each other's prescribed burns and assist with burn planning and preparation. Participation in this agreement is fully voluntary. While support conducting prescribed burns from council members is common, support through this agreement is not enough to provide minimum staffing levels to execute prescribed burns (See Appendix F).

DMAVS has also had agreements with the WMNF to provide wildland fire and prescribed burn planning and implementation. These agreements with the WMNF provide reimbursement to the Forest Service for services such as prescribe fire planning, preparation and execution. Agreements with the Forest Service covered 2012-2016 and 2017-2019. Another agreement with the Forest Service or other agency or private contractor will be needed to execute this IWFMP.

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List of Acronyms DMAVS/NHARNG IWFMP

AASF Army Aviation Support Facility
ACSIM Assistant Chief of Staff for Installation Management
AO Administrative Officer
ATV All terrain vehicle
BI Burning Index
BUI Build Up Index
CFMO Construction and Facilities Management Officer
CMA Concord Municipal Airport
DAOF Dry Appalachian oak forest
DES Department of Environmental Services
DMAVS Department of Military Affairs & Veterans Services
DoD Department of Defense
EA Environmental Assessment
FD Fire Department
FEMO Fire Effects Monitor
FOBS Field Observer
FOFEM First Order Fire Effects Model
GIS Geographic Information System
GPS Global Positioning System
HIMARS High Mobility Artillery Rocket System
IC Incident Commander
ICRMP Installation Cultural Resource management Plan
INRMP Installation Resource Management Plan
IQS Incident Qualifications System
ITAM Integrated Training Area Management
IWFMP Integrated Wildland Fire Management Plan
JOC Joint Operation Center
KBB Karner Blue Butterfly
KBDI Keetch-Byram Drought index
NAAQS National Ambient Air Quality Standards
NEPA National Environmental Policy Act
NFFL National Forest Fire Laboratory
NHDNCR New Hampshire Department of Natural and Cultural Resources
NHARNG New Hampshire Army National Guard
NHDES New Hampshire Department of Environmental Services
NHDFS New Hampshire Division of Forest and Lands
NHF&G New Hampshire Department of Fish and Game
NHNHB New Hampshire Natural Heritage Bureau
NHPFC New Hampshire Prescribed Fire Council
NWCG National Wildfire Coordinating Group
NWS National Weather Service

PAO Public Affairs Officer
PPE Personal Protective Equipment
PPSOB Pitch Pine Scrub-Oak Barrens
PPSOW Pitch pine scrub-oak woodlands
RAWS Remote Automated Weather System
RDP Range Development Plan
ROW Right of Way
ECTC Edward Cross Training Complex
RxB Prescribed Burn Boss
SHPO State Historic Preservation Office
SMR State Military Reservation
SOP Standard Operating Procedures
T&E Threatened & Endangered
TAG The Adjutant General
TASS Total Army School System
TBD To Be Determined
USACE United States Army Corps of Engineers
USFWS United States Fish and Wildlife Service
UTV Utility Type Vehicle
UXO Unexploded Ordnance
WFPM Wildland Fire Program Manager
WMNF White Mountain National Forest
WPA Wellhead Protection Area
WUI Wildland Urban Interface

Glossary

The following information was taken from the NWCG *Glossary of Wildland Fire Terminology PMS 205 July 2012* and contains definitions applicable to this IWFMP. For the complete list of Wildland Fire Terms go to: http://www.nwcg.gov/pms/pubs/glossary/pms205.pdf

A

Accelerant

1. Material (usually a flammable liquid) used to initiate or increase the spread of a fire.

Adapter

1. A device for connecting hoses of the same size with non-matching hose threads, or connecting a threaded coupling to a quick-connect coupling.

Air Quality

1. The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations. Used instead of "air pollution" when referring to programs.

Ambient Air

1. Air of the surrounding environment.

Anchor Point

1. An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed.

Arson

1. At common law, the malicious and willful burning of another's dwelling, outhouse or parcel; by most modern statutes, the intentional and wrongful burning of someone else's, or one's own, property. Frequently requires proof of malicious or wrongful intent.

Aspect

1. Cardinal direction toward which a slope faces.

Attainment Area

1. An area considered to have air quality as good as, or better than, the National Ambient Air Quality Standards (NAAQS) as defined in the Clean Air Act. An area may be in attainment for one or more pollutants but be in nonattainment for one or more other pollutants.

Average Annual Precipitation

1. The expected amount of annual rainfall. Average annual precipitation is an important component to determining the Keech-Bryam Drought Index (KBDI).

Average Temperature

1. The mathematical average of the maximum and minimum dry-bulb temperatures measured at a fire weather station from one basic observation time to the next.

Avoidance

1. A smoke emission control strategy that considers meteorological conditions when scheduling prescribed fires in order to avoid incursions into smoke sensitive areas.

B

Backing Fire

1. Fire spreading, or ignited to spread, into (against) the wind or downslope. A fire spreading on level ground in the absence of wind is a backing fire.
2. That portion of the fire with slower rates of fire spread and lower intensity normally moving into the wind and/or down slope. Also called: heel fire.

Backpack Pump

1. A portable sprayer with hand-pump, fed from a liquid filled container fitted with straps, used mainly in fire and pest control.

Barrier

1. Any obstruction to the spread of fire. Typically an area or strip devoid of combustible fuel.

Brush

1. A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees, usually of a type undesirable for livestock or timber management.

Buildup Index (BUI)

1. A relative measure of the cumulative effect of daily drying factors and precipitation on fuels with a ten-day timelag.

Burn Boss

1. Person responsible for supervising a prescribed fire from ignition through mopup.

Burn

1. An area burned over by wildland fire.
2. A reference to a working fire.
3. An injury to flesh caused by a cauterizing agent, heat from a fire, or a heated object a) First Degree Burn: A burn which causes only pain, redness, and swelling. b) Second Degree

Burn: A burn in which the skin is blistered. c) Third Degree Burn: A flesh burn in which charring occurs.
4. To be on fire.
5. To consume fuel during rapid combustion.
6. A fire in progress or under investigation.

Burning Conditions
1. The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Burning Out
1. Setting fire inside a control line to consume fuel located between the edge of the fire and the control line.

Burning
1. Decomposition of material by the application of heat and oxidation. Also applied to propellants and other pyrotechnic mixtures, though the proper term there is "reacting". Also often an element of the crime of arson.

C

Cache
1. A pre-determined complement of tools, equipment and/or supplies stored in a designated location, available for incident use.

Canopy
1. The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Chain of Command
1. A series of management positions in order of authority.

Class A Foam
1. Foam intended for use on Class A or woody fuels; made from hydrocarbon-based surfactant, therefore lacking the strong filming properties of Class B foam, but possessing excellent wetting properties.

Clean Air Act
1. A federal law enacted to ensure that air quality standards are attained and maintained. Initially passed by Congress in 1963, it has been amended several times.

Consumption
1. The amount of a specified fuel type or strata that is removed through the fire process, often expressed as a percentage of the preburn weight.

Contained
1. The status of a wildfire suppression action signifying that a control line has been completed around the fire, and any

associated spot fires, which can reasonably be expected to stop the fire's spread.

Contingency Plan

1. The portion of a prescribed fire plan, incident action plan, or wildland fire use implementation plan that identifies possible but unlikely events and the contingency resources needed to mitigate those events.

Controlled

1. The completion of control line around a fire, any spot fires therefrom, and any interior islands to be saved; burned out any unburned area adjacent to the fire side of the control lines; and cool down all hot spots that are immediate threats to the control line, until the lines can reasonably be expected to hold under the foreseeable conditions.

Criteria Pollutants

1. Pollutants deemed most harmful to public health and welfare and that can be monitored effectively. They include carbon monoxide (CO), lead (Pb), nitrogen oxides (Nox), sulfur dioxide (SO2), ozone (O3), particulate matter (PM) of aerodynamic diameter less than or equal to 10 micrometers (PM10) and particulate matter of aerodynamic diameter less than or equal to 2.5 micrometers (PM2.5).

D

Dead Fuels

1. Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation).

Dilution

1. A control strategy used in managing smoke from prescribed fires in which smoke concentration is reduced by diluting it through a greater volume of air, either by scheduling during good dispersion conditions or burning at a slower rate.

Discovery

1. Determination that a fire exists. Location and reporting of a fire is not required as is with detection.

Dispatch Center

1. A facility from which resources are assigned to an incident.

Dispatch

1. The implementation of a command decision to move a resource or resources from one place to another.

Dispersion

1. The decrease in concentration of airborne pollutants as they spread throughout an increasing volume of atmosphere.

Disturbance

1. A weather system usually associated with clouds, rain and/or wind.

Division

1. The ICS organization level between the branch and the task force/strike team. Divisions are used to divide an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the span-of-control of the operations chief.

Draft

1. Drawing water from static sources such as a lake, pond, cistern, river, etc. into a pump which is above the level of the water supply. This is done by removing the air from the pump and allowing atmospheric pressure [14.7 psi (101 kPa) at sea level] to push water through a non-collapsible suction hose into the pump.

Drip Torch

1. Hand-held device for igniting fires by dripping flaming liquid fuel on the materials to be burned; consists of a fuel fount, burner arm, and igniter. Fuel used is generally a mixture of diesel and gasoline.

Drought

1. A period of relatively long duration with substantially below-normal precipitation, usually occurring over a large area.

Dry Bulb

1. A name given to an ordinary thermometer used to determine the temperature of the air (to distinguish it from the wet bulb).

Duff

1. The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil.

E

Ecosystem

1. An interacting natural system including all the component organisms together with the abiotic environment and processes affecting them.

Edge

1. The place where plant communities meet or where successional stages or vegetative conditions within plant communities come together.
2. The boundary between two fairly distinct fuel types.

Emission Reduction

1. A strategy for controlling smoke from prescribed fires that minimizes the amount of smoke output per unit area treated.

Emission

1. A release of combustion gases and aerosols into the atmosphere.

Entrapment

1. A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses."

Environment

1. The complex surroundings of an item or area of interest, such as air, water, natural resources, and their physical conditions (temperature, humidity).

Escape Route

1. A preplanned and understood route firefighters take to move to a safety zone or other low-risk area. When escape routes deviate from a defined physical path, they should be clearly marked (flagged).

Exposure

1. Property that may be endangered by a fire burning in another structure or by a wildfire.
2. Direction in which a slope faces, usually with respect to cardinal directions.
3. The general surroundings of a site with special reference to its openness to winds.

Extended Attack Incident

1. A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, enroute, or being ordered by the initial attack incident commander. Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

Extended Attack

1. Suppression activity for a wildfire that has not been contained or controlled by initial attack or contingency forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

Exterior Fire Protection

1. The protection of structures from the exterior, with no interior access or activity.

F

Fire Behavior

1. The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Crew

1. General term for two or more firefighters organized to work as a unit.

Fire Danger Rating

1. A fire management system that integrates the effects of selected fire danger factors into one or more qualitative or numerical indices of current protection needs.

Fire Danger

1. Sum of constant danger and variable danger factors affecting the inception, spread, and resistance to control, and subsequent fire damage; often expressed as an index.

Fire Dependent

1. Plants and vegetation communities which have evolved adaptations such as a reliance on fire as a disturbance agent, protection as a species against the effects of wildland fire, or even a strengthening or enhancement by it.

Fire Effects

1. The physical, biological, and ecological impacts of fire on the environment.

Fire Environment

1. The surrounding conditions, influences, and modifying forces of topography, fuel, and weather that determine fire behavior.

Fire Hazard

1. A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.

Fire Management Plan (FMP)

1. A plan which identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans, including but not limited to preparedness plans, preplanned dispatch plans, and prevention plans. Fire Management Plans assure that wildland fire management goals and components are coordinated.

Fire Management Unit (FMU)

1. A land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, etc. that set it apart from the characteristics of an adjacent FMU. The FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

Fire Management

1. Activities required for the protection of burnable wildland values from fire and the use of prescribed fire to meet land management objectives.

Fire Potential

1. The likelihood of a wildland fire event measured in terms of anticipated occurrence of fire(s) and management's capability to respond. Fire potential is influenced by a sum of factors that includes fuel conditions (fuel dryness and/or other inputs), ignition triggers, significant weather triggers, and resource capability.

Fire Prevention

1. Activities such as public education, community outreach, law enforcement, engineering, and reduction of fuel hazards that are intended to reduce the incidence of unwanted human-caused wildfires and the risks they pose to life, property or resources.

Fire Qualifications

1. Computerized interagency summary of fire suppression qualifications of listed personnel. Available information includes fire training record, fire experience record, and physical fitness testing score for each individual.

Fire Regime

1. Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.

Fire Return Interval

1. The number of years between two successive fire events for a given area; also referred to as fire-free interval or fire-return interval.

Fire Risk

1. The chance of fire staging, as determined by the presence and activity of causative agents.
2. A causative agent.
3. A number related to the potential number of firebrands to which a given area will be exposed during the rating day (National Fire Danger Rating System).

Fire Season

1. Period(s) of the year during which wildland fires are likely to occur, spread, and affect resources values sufficient to warrant organized fire management activities.
2. A legally enacted time during which burning activities are regulated by federal, state or local authority.

Fire Service

1. The organized fire protection service; its members, individually and collectively; allied organizations assisting protection agencies.

Fire Shelter Deployment

1. The removing of a fire shelter from its case and using it as protection against fire.

Fire Shelter

1. An aluminized tent offering protection by means of reflecting radiant heat and providing a volume of breathable air in a fire entrapment situation. Fire shelters should only be used in life threatening situations, as a last resort.

Fire Spread Model

1. A set of physics and empirical equations that form a mathematical representation of the behavior of fire in uniform wildland fuels.

Fire Suppression

1. All work and activities connected with control and fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fire Weather Forecast

1. A weather prediction specially prepared for use in wildland fire operations and prescribed fire.

Fire Weather Watch

1. A Fire Weather Watch is issued to advise of conditions which could result in extensive wildland fire occurrence or extreme fire behavior, which are expected to develop in the next 12 to 48 hours, but not more than 72 hours. In cases of dry lightning, a Fire Weather Watch may be issued for the next 12 hours.

Fire Weather

1. Weather conditions which influence fire ignition, behavior, and suppression.

Fire

1. Rapid oxidation, usually with the evolution of heat and light; heat, fuel, oxygen and interaction of the three.

Firebreak

1. A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

FIREFAMILY (Fire Data Program)

1. A computer program that uses historical weather and fire data for fire planning. Its three major routines are FIRDAT, SEASON, and FIRINF.

Firefighter

1. Person whose principal function is fire suppression.

Fireline

1. The part of a containment or control line that is scraped or dug to mineral soil.

Firing Technique

1. Any method or pattern of igniting a wildland area to consume the fuel in a prescribed pattern. E.g., heading or backing fire, spot fire, strip-head fire, and ring fire.

First Order Fire Effects (FOFE)

1. The effects that concern the direct or immediate consequences of fire, such as biomass consumption, crown scorch, bole damage, and smoke production. First order effects form an important basis for predicting secondary effects such as tree regeneration, plant succession, and changes in site productivity, but these involve interaction with many other non-fire variables.

Flame Length

1. The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.

Flame

1. A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.
2. Light given off by burning gasses during the combustion process.

Flaming Combustion Phase

1. Luminous oxidation of gases evolved from the rapid decomposition of fuel. This phase follows the pre-ignition phase and precedes the smoldering combustion phase, which has a much slower combustion rate. Water vapor, soot, and tar comprise the visible smoke. Relatively efficient combustion produces minimal soot and tar, resulting in white smoke; high moisture content also produces white smoke.

Flammable

1. Easily ignitable and capable of burning and producing flames.

Foam

1. The aerated solution created by forcing air into, or entraining air in water containing a foam concentrate by means of suitably designed equipment or by cascading it through the air at a high velocity. Foam reduces combustion by cooling, moistening and excluding oxygen.

Forest Fire

1. Variously defined for legal purposes (e.g., the State of California Public Resources Code: uncontrolled fire on lands covered wholly or in part by timber, brush, grass, grain, or other flammable vegetation). Types of fires are ground, surface, and crown.

Forest Protection

1. Forestry branch concerned with prevention and damage control to forests from human actions (unauthorized fire, grazing, felling, smoke), pests and pathogens, and damage from storm, frost, and other climatic agents.

Forest Service

1. Generally understood to mean an agency of the U.S. Department of Agriculture. However, some states also use Forest Service, e.g., Colorado State Forest Service.

Fuel Bed Depth

1. Average height of surface fuels contained in the combustion zone of a spreading fire front.

Fuel Bed

1. An array of fuels usually constructed with specific loading, depth, and particle size to meet experimental requirements; also, commonly used to describe the fuel composition.

Fuel Loading

1. The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area. This may be available fuel (consumable fuel) or total fuel and is usually dry weight.

Fuel Management

1. Act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological, or manual means, or by fire, in support of land management objectives.

Fuel Model

1. Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Reduction

1. Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

Fuel Treatment

1. Manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).

Fuel Type

1. An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions.

Fuel

1. Any combustible material, especially petroleum-based products and wildland fuels.

Fuelbreak

1. A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.

Fusee

1. A colored flare designed as a railway warning device, widely used to ignite backfires and other prescribed fires.

G

Grass Fire

1. Any fire in which the predominant fuel is grass or grass-like.

H

Hazard

1. Any real or potential condition that can cause injury, illness or death of personnel, or damage to, or loss of equipment or property.

Haze

1. A sufficient concentration of atmospheric aerosols to affect a visible attenuation of light and measurable reduction in visual range. The aerosol particle diameter is near the wavelength of visible light, optimizing the light scattering efficiency of the particles.

Head Fire

1. A fire spreading or set to spread with the wind.

Herb

1. A plant that does not develop woody, persistent tissue but is relatively soft or succulent and sprouts from the base (perennials) or develops from seed (annuals) each year. Includes grasses, forbs and ferns.

Humidity

1. General term referring to the moisture content of the atmosphere.

I

Ignition Pattern

1. Manner in which a prescribed fire is ignited. The distance between ignition lines or points and the sequence of igniting them is determined by weather, fuel, topography, firing technique, and other factors which influence fire behavior and fire effects.

Incendiary

1. A burning compound or metal used to produce intense heat or flame, like a bomb.

Incident Command System (ICS)

1. A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Incident Commander (ICT1, ICT2, ICT3, ICT4, or ICT5)

1. This ICS position is responsible for overall management of the incident and reports to the Agency Administrator for the agency having incident jurisdiction. This position may have one or more deputies assigned from the same agency or from an assisting agency(s).

Incident

1. An occurrence either human-caused or natural phenomenon, that requires action or support by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

Initial Action

1. The actions taken by the first resources to arrive at a wildfire or wildland fire use incident. Initial actions may be size up, patrolling, monitoring, holding action or aggressive initial attack.

Initial Attack (IA)

1. A planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the fire and put it out in a manner consistent with firefighter and public safety and values to be protected.

J

K

Keetch-Byram Drought Index (KBDI)

1. An estimate (0-800) of the amount of precipitation (in 100ths of inches) needed to bring the top 8 inches of soil back to saturation. A value of 0 is complete saturation of the soil, a value of 800 means 8.00 inches of precipitation would be needed for saturation. In the 1988 version of NFDRS, outputs of KBDI are used to adjust live and dead fuel loadings.

L

Leader's Intent

1. A concise statement that outlines what individuals must know in order to be successful for a given assignment. The intent communicates three essential pieces of information: - Task – What is the goal or objective - Purpose – Why it is to be done - End state – How it should look when successfully completed

Leadership

1. The art of providing purpose, direction, and motivation to a group of people in order to accomplish a mission and improve the organization. Leaders provide purpose by clearly communicating their intent and describing the desired end state of an assignment to their followers. Leaders provide direction by maintaining standards of performance for their followers. Leaders provide motivation by setting the example for their followers.

Litter

1. The top layer of forest floor, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles; little altered in structure by decomposition.

Local Winds

1. Winds which are generated over a comparatively small area by local terrain and weather. They differ from those which would be appropriate to the general pressure pattern.

Lookout

1. A person designated to detect and report fires from a vantage point.
2. A location from which fires can be detected and reported.
3. A fire crew member assigned to observe the fire and warn the crew when there is danger of becoming trapped.

M

Mcleod

1. A combination hoe or cutting tool and rake, with or without removable blades.

Mineral Soil

1. Soil layers below the predominantly organic horizons; soil with little combustible material.

Mitigation

1. Those activities implemented prior to, during, or after an incident which are designed to reduce or eliminate risks to persons or property that lessen the actual or potential effects or consequences of an incident. Mitigation measures can include efforts to educate governments, businesses, and the general public on measures they can take to reduce loss and injury and are often informed by lessons learned from prior incidents.

Moisture of Extinction

1. The fuel moisture content, weighed over all the fuel classes, at which the fire will not spread. Also called extinction moisture content (EMC).

Monitoring

1. The orderly collection, analysis, and interpretation of environmental data to evaluate management's progress toward meeting objectives, and to identify changes in natural systems. Monitoring is also conducted on wildland fires to observe fire effects, fire behavior, or both. For example, the work done by Fire Effects Monitor (FEMO) or Field Observer (FOBS) positions.

Mop Up

1. Extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke.

Mutual Aid Agreement

1. Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing personnel and equipment.

Mutual Aid

1. Assistance in firefighting or investigation by fire agencies, without regard for jurisdictional boundaries.

N

National Ambient Air Quality Standards (NAAQS)

1. A legal limit on the level of atmospheric contamination. The level is established as the concentration limits needed to protect all of the public against adverse effects on public health and welfare, with an adequate safety margin. Primary standards are those related to health effects. Secondary standards are designed to protect the public welfare from effects such as visibility reduction, soiling, material damage and nuisances.

National Fire Protection Association (NFPA)

1. A private, non-profit organization dedicated to reducing fire hazards and improving fire service.

National Interagency Fire Center (NIFC)

1. A facility located at Boise, Idaho, jointly operated by several federal agencies, dedicated to coordination, logistical support, and improved weather services in support of fire management operations throughout the United States.

National Interagency Incident Management System (NIIMS)

1. An NWCG developed program consisting of five subsystems which collectively provide a total systems approach to all-risk incident management. The subsystems are: The Incident Command System, Training, Qualifications and Certification, Supporting Technologies, and Publications Management.

National Pipe Straight Hose Thread (NPSH)

1. Also known as National Pipe Straight Mechanical (NPSM) thread. This is a straight (non-tapered) thread standard with the same threads per inch as the appropriate size iron pipe thread. It requires a gasket to seal and is the thread standard used by most U.S. industry.

National Wildfire Coordinating Group (NWCG)

1. A group formed under the direction of the Secretaries of the Interior and Agriculture to improve the coordination and effectiveness of wildland fire activities and provide a forum to

discuss, recommend appropriate action, or resolve issues and problems of substantive nature.

Native Species

1. A species which is a part of the original fauna or flora of the area in question.

Nomex ®

1. Trade name for a fire resistant synthetic material used in the manufacturing of flight suits and pants and shirts used by firefighters. Aramid is the generic name.

Non-attainment Area

1. An area identified by an air quality regulatory agency through ambient air monitoring (and designated by the Environmental Protection Agency), that presently exceeds federal ambient air standards.

O

Objective

1. A description of a desired condition; quantified and measured, and where possible, with established time frames for achievement.
2. Specific, achievable, measurable, time-limited results to be achieved through land management practices, either through a description of a desired condition or the degree of desired change in an attribute.

Officer

1. The ICS title for personnel responsible for the Command Staff positions of Safety, Liaison, and Information.

P

Particulate Matter

1. Any liquid or solid particles. "Total suspended particulates", as used in air quality, are those particles suspended in or falling through the atmosphere. They generally range in size (diameter) from 0.1 to 100 micrometers.

Partners

1. All agencies and organizations that engage in joint decision making with federal agencies in planning and conducting fire management projects and activities.

Patrol

1. To travel over a given route to prevent, detect, and suppress fires. Includes interaction with the public for wildland fire prevention and educational purposes.

2. To go back and forth vigilantly over a length of control line during and/or after construction to prevent breakovers, suppress spot fires, and extinguish overlooked hot spots.
3. A person or group of persons who carry out patrol actions.

Personal Protective Equipment (PPE)

1. That equipment and clothing required to mitigate the risk of injury from or exposure to hazardous conditions encountered during the performance of duty. PPE includes but is not limited to: fire resistant clothing, hard hat, flight helmets, shroud, goggles, gloves, respirators, hearing protection, chainsaw chaps, and shelter.

Plume

1. A convection column generated by combustion (of wildland fuel).

Portable Pump

1. Small gasoline-driven pump that can be carried to a water source by one or two firefighters or other conveyance over difficult terrain.

Pounds per Square Inch (PSI)

1. Measurement of pressure (e.g., pump pressure, nozzle pressure, friction loss in hose, pressure loss or gain due to elevation).

Precipitation

1. Any or all forms of water particles, liquid or solid, that fall from the atmosphere and reach the ground.

Preparedness

1. Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.
2. Mental readiness to recognize changes in fire danger and act promptly when action is appropriate.
3. The range of deliberate, critical tasks, and activities necessary to build, sustain, and improve the capability to protect against, respond to, and recover from domestic incidents.

Prescribed Burning

1. Application of prescribed fire.

Prescribed Fire Burn Plan

1. A plan required for each fire application ignited by management. Plans are documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire will be

conducted (a prescription). Plan content varies among the agencies.

Prescribed Fire

1. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

Prescription

1. Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions.

Prevention

1. Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards (fuels management).
2. Actions to avoid an incident, to intervene for the purpose of stopping an incident from occurring, or to mitigate an incident's effect to protect life and property. Includes measures designed to mitigate damage by reducing or eliminating risks to persons or property, lessening the potential effects or consequences of an incident.

Probability of Ignition

1. The chance that a firebrand will cause an ignition when it lands on receptive fuels.

Protection Area

1. That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the firefighting agent (e.g., a lumber operator). Several agencies or entities may have some basic responsibilities (e.g., private owner) without being known as the fire organization having direct protection responsibility.

Protection

1. The actions taken to limit the adverse environmental, social, political, and economical effects of fire.

Pulaski

1. A combination chopping and trenching tool widely used in fireline construction, which combines a single-bitted axe blade with a narrow adze-like trenching blade fitted to a straight handle.

Pyrotechnic

1. A mixture of chemicals designed to produce heat, light, gas, smoke or noise.

Q

R

Rate of Spread

1. The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

Readiness

1. Condition or degree of being completely ready to cope with a potential fire situation.
2. Mental readiness to recognize changes in fire danger and act promptly when action is appropriate.

Reburn

1. Repeat burning of an area over which a fire has previously passed, but left fuel that later ignites when burning conditions are more favorable.
2. An area that has re-burned.

Recovery

1. The increase in fuel moisture as a result of increased relative humidity, usually occurring overnight.
2. The general term used to describe the maximum overnight value of atmospheric relative humidity.

Relative Humidity (RH)

1. The ratio of the amount of moisture in the air, to the maximum amount of moisture that air would contain if it were saturated. The ratio of the actual vapor pressure to the saturated vapor pressure.

Remote Automatic Weather Station (RAWS)

1. A weather station that transmits weather observations via GOES satellite to the Wildland Fire Management Information system.

Required Experience

1. Documented, satisfactory performance in a specified position needed to qualify for another (usually higher level) position. Required experience cannot be challenged.

Required Training

1. A course or courses that must be completed prior to initiating a position task book. Training which has been identified as required cannot be challenged; an agency equivalent course may be used as a substitute when the course meets or exceeds a required course's learning and performance objectives.

Resource Capability

1. The ability of the wildland fire program to respond to current and anticipated workload needs for the area of concern.

Resources

1. Personnel, equipment, services and supplies available, or potentially available, for assignment to incidents. Personnel and equipment are described by kind and type, e.g., ground, water, air, etc., and may be used in tactical, support or overhead capacities at an incident.
2. The natural resources of an area, such as timber, grass, watershed values, recreation values, and wildlife habitat.

Ring Fire

1. A fire started by igniting the full perimeter of the intended burn area so that the ensuing fire fronts converge toward the center of the burn. Set around the outer perimeter of a resource to establish a protective black-line-buffer.

Risk Management (RM)

1. A continuous, five-step process that provides a systematic method for identifying and managing the risks associated with any operation.

S

Safety Briefing

1. A safety briefing emphasizes key safety concerns on the incident and is presented at each briefing session. The safety briefing should contain information to alert incident personnel of potential risk/hazard considered to be most critical.

Safety Officer

1. A member of the command staff responsible to the incident commander for monitoring and assessing hazardous and unsafe situations, and developing measures for assessing personnel safety.

Safety Zone

1. An area cleared of flammable materials used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress so as to maintain a safety zone

close at hand allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks; they are greatly enlarged areas which can be used with relative safety by firefighters and their equipment in the event of blowup in the vicinity.

Shaded Fuelbreak

1. Fuelbreaks built in timbered areas where the trees on the break are thinned and pruned to reduce the fire potential yet retain enough crown canopy to make a less favorable microclimate for surface fires.

Shrub

1. A woody perennial plant differing from a perennial herb by its persistent and woody stem; and from a tree by its low stature and habit of branching from the base.

Single Resource

1. An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor that can be used on an incident.

Smoke Intrusion

1. Smoke from prescribed fire entering a designated area at unacceptable levels.

Smoke Management

1. The policies and practices implemented by air and natural resource managers directed at minimizing the amount of smoke entering populated areas or impacting sensitive sites, avoiding significant deterioration of air quality and violations of National Ambient Air Quality Standards, and mitigating human-caused visibility impacts in Class I areas.

Smoke

1. Small particles of carbon, tarry and water vapor resulting from the incomplete combustion of carbonaceous materials such as wood, coal or oil.

Spot Fire

1. Fire ignited outside the perimeter of the main fire by a firebrand.

Spot Weather Forecast

1. A special forecast issued to fit the time, topography, and weather of a specific incident. These forecasts are issued upon request of the user agency and are more detailed, timely, and specific than zone forecasts. Usually, on-site weather observations or a close, representative observation is required for a forecast to be issued.

Spotting

1. Behavior of a fire producing sparks or embers that are carried by the wind and which start new fires beyond the zone of direct ignition by the main fire.

Spread Index

1. A number used to indicate relative (not actual) rate of spread.

Standard Operating Procedure (SOP)

1. Specific instructions clearly spelling out what is expected of an individual every time they perform a given task. A standard operating procedure can be used as a performance standard for tasks that are routinely done in the operational environment.

State Park

1. An area established by the government of a state primarily for public recreation or for the preservation of unique natural or historic resources, administrative details varying widely.
   NOTE: Such parks may also be established by lesser administrative units, e.g. counties, municipalities, and also by large private owners.

Strategy

1. The general plan or direction selected to accomplish incident objectives.

Structure (Vegetative)

1. The arrangement of vegetation in terms of density, basal area, cover, and vertical arrangement.

Suppression

1. All the work of extinguishing or confining a fire beginning with its discovery.

Surface Fire

1. Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation.

Surface Fuel

1. Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

T

Tactics

1. Deploying and directing resources on an incident to accomplish the objectives designated by strategy.

Thermal Belt

1. An area of mountainous slope (characteristically the middle third), where the top of the radiation inversion intersects the

slope. It typically experiences the least variation in diurnal temperatures and has the highest average temperatures and, thus, the lowest relative humidity. Its presence is most evident during clear weather with light wind.

Timelag (TL)

1. Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after 4 timelag periods.

Torching

1. The burning of the foliage of a single tree or a small group of trees, from the bottom up.

Total Fuel

1. All plant material both living and dead that can burn in a worst case situation.

Trainee

1. An individual who has met all required training and position experience for a specified position and is approved by their home unit's certifying official, to initiate a performance based training assignment in order to become qualified in the position.

U

Unified Command

1. In ICS, unified command is a unified team effort which allows all agencies with jurisdictional responsibility for the incident, either geographical or functional, to manage an incident by establishing a common set of incident objectives and strategies. This is accomplished without losing or abdicating authority, responsibility, or accountability.

Unit

1. The organizational element of an incident having functional responsibility for a specific activity in the planning, logistics, or finance/administration activity.

W

Water Source

1. Any strategically located supply of water that is readily available for pumps, tanks, trucks, helicopters, or fire camp use.

Wildfire Suppression

1. An appropriate management response to wildfire, escaped wildland fire use or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

Wildfire

1. An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Wildland Fire

1. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

Wildland Urban Interface (WUI)

1. The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Wildland

1. An area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered.

Wind Direction

1. Compass direction from which wind is blowing.

Wind Speed

1. Wind, in miles per hour, measured at 20 feet above open, level ground or as adjusted to meet this standard to compensate for height of ground cover, uneven ground, and nearby obstructions.
2. (NFDRS) Wind, in mph, measured at 20 feet above ground, or above the average height of vegetation, and averaged over at least a 10-minute period. Also called wind velocity.

Work Capacity Test (WCT)

1. A family of tests to determine firefighter physical capabilities. Work capacity tests are used to ensure that persons assigned to fire activities are physically capable of performing the duties of wildland firefighting and to meet National Wildfire Coordinating Group (NWCG) standards for wildland firefighters (Wildland Fire Qualification Subsystem Guide 310-

1, NWCG, 1993). The WCT is a family of tests to determine firefighter physical capabilities at three levels: Arduous: "Duties involve field work requiring physical performance calling for above-average endurance and superior conditioning. These duties may include an occasional demand for extraordinarily strenuous activities in emergencies under adverse environmental conditions and over extended periods. Requirements include running, walking, climbing, jumping, twisting, bending, and lifting more than 50 pounds; the pace of work typically is set by the emergency condition." Moderate: "Duties involve field work requiring complete control of all physical faculties and may include considerable walking over irregular ground, standing for long periods, lifting 25 to 50 pounds, climbing, bending, stooping, squatting, twisting, and reaching. Occasional demands may be required for moderately strenuous activities in emergencies over long periods. Individuals usually set their own work pace." Light: "Duties mainly involve office-type work with occasional field activity characterized by light physical exertion requiring basic good health. Activities may include climbing stairs, standing, operating a vehicle, and long hours of work, as well as some bending, stooping, or light lifting. Individuals almost always can govern the extent and pace of their physical activity" Each performance level has its own unique Work Capacity Test: Pack Test: The pack test is a job-related test of the capacity for arduous work. It consists of a 3-mile hike with a 45-pound pack over level terrain. A time of 45 minutes, the passing score for the test, approximates an aerobic fitness score of 45, the established standard for wildland firefighters. Field Test: The field test is a job-related test of work capacity designed for those with moderately strenuous duties. It consists of a 2-mile hike with a 25-pound pack. A time of 30 minutes, the passing score, approximates an aerobic fitness score of 40. Walk Test: The walk test is designed to determine the ability to carry out light duties. It consists of a 1-mile test with no load that approximates an aerobic fitness score of 35. A time of 16 minutes, the passing score for the test, ensures the ability to meet emergencies and evacuate to a safety zone.

Z

Appendix A - NH Natural Community Descriptions

HABITAT PROFILE

Appalachian Oak Pine Forest

Associated Species: Timber rattlesnake, eastern hognose snake, whip-poor will, veery, eastern pipistrelle, eastern red bat, northern myotis, silver haired bat, bobcat, black bear

Global Rank: Not ranked
State Rank: Not ranked
Author: Carol R. Foss, Audubon Society of New Hampshire

Element 1: Distribution and Habitat

1.1 Habitat description

Appalachian oak pine forest systems are found mostly below 900 ft elevation in southern New Hampshire south of and at lower elevations than the hemlock-hardwood-pine forest system. The southern-most portions of the state are associated with the warmer and drier climatic conditions and apparently more fire-influenced landscapes that prevail south of New Hampshire in lower New England. Substrates in these forests include nutrient-poor, dry to mesic sandy glacial tills, and some large areas of sand plain or shallow-to-bedrock tills, particularly in the seacoast and lower Merrimack and Connecticut River valleys. Sand plains in these areas that have a frequent fire history correspond to pitch pine sand plain; those with a less frequent fire regime (i.e., more than 50 to 100 years) are classified as oak pine forest or sometimes hemlock hardwood pine forest systems depending on the composition of trees. More isolated patches of oak pine forest systems are found to the north in central New Hampshire associated with dry rocky ridges or sand plains with a historic fire regime.

1.2 Justification

Appalachian oak pine forest currently has a limited distribution in New Hampshire, covering less than 10% of the state's land area. Available data indicate that only 7.3% of the state's potential Appalachian oak pine forest is on permanently protected lands. This forest type supports 104 vertebrate species in New Hampshire, including 8 amphibians, 12 reptiles, 67 birds, and 17 mammals. Threatened and endangered wildlife species occurring in this forest type include osprey, Cooper's hawk, timber rattlesnake, and eastern hognose snake. In New Hampshire, intense development has dramatically reduced the area of this forest type influenced by natural disturbance regimes, resulting in a preponderance of the forest currently in older age classes. A full range of age classes well distributed on the landscape is important to support the diversity of wildlife species that depend on this forest type.

1.3 Protection and Regulatory Status

Most of New Hampshire's Appalachian oak pine forest occurs on small, privately owned parcels. Less than 15% of this forest type occurs on conservation lands. Forestry on state lands is covered by RSAs 216, 217, and 218. RSA 227 stipulates requirements for residual basal area in riparian areas. The manuals "Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire" (Cullen 1996) and "Good Forestry in the Granite State" (FSSWT 1996) provide recommended management practices for sustainable forestry in New Hampshire.

1.4 Distribution

Appalachian oak pine forest occurs primarily in southern New Hampshire, with more than 40%

by area in Rockingham County and approximately 20%, 15%, and 10% in Hillsborough Strafford, and Cheshire counties, respectively.

1.5 Town Distribution Map

See attached.

1.6 Habitat Map

To develop a map of Appalachian oak pine forest in New Hampshire, a model was developed for each ecoregion subsection of the state based on the 2001 New Hampshire Land Cover Assessment, elevation, landform, and soils. The model was developed by experts from The Nature Conservancy (TNC), the New Hampshire Natural Heritage Bureau (NHNHB), and New Hampshire Fish and Game (NHFG).

First, relevant forested 2001 New Hampshire Land Cover Assessment grid values were combined with elevation ranges from sea level to 900' (CSRC 2001, USGS 2003). Ecological Land Units, created by The Nature Conservancy's Conservation Science Support, were then added to capture additional areas likely to have geo-physical conditions favorable to Appalachian oak pine, or remove areas likely to have geo-physical conditions unfavorable to Appalachian oak pine (TNC 2003). Specifically, north-facing side slopes and north-facing coves were removed from some land cover/elevation classes, and some land cover/elevation classes were restricted to only south-facing sideslopes and south-facing coves.

During previous fieldwork, NHNHB mapped exemplary Dry Appalachian oak-hickory forest, Mesic Appalachian oak-hickory forest, Appalachian oak-mountain laurel forest, and Semi-rich Appalachian oak-sugar maple forest systems in the state. These areas were added to ensure that known Appalachian oak pine locations were captured (NHNHB 2005). These data do not capture all existing locations of these communities, only those that have been mapped by NHNHB.

To further refine the model, soil types associated with Appalachian oak pine were identified by Natural Resource Conservation Service scientists and selected from digitized county soil data, where available (e.g., Merrimack county soils have not been digitized) (NRCS 2002, Homer 2005). The soils were selected, and then clipped to only include forested areas based on the New Hampshire Landcover Assessment, and added to the existing model information. The same was done for hemlock-hardwood-pine, and then Appalachian oak pine was used to erase areas from hemlock-hardwood-pine where there was overlap, so that Appalachian oak pine takes precedence over hemlock-hardwood-pine. NHFG then applied a filter to determine the majority forest type between neighboring polygons in the TNC model, and smoothed the boundaries to generalize the transition between matrix forest types. This process is expected to somewhat over-predict current locations of Appalachian oak pine, but it captures better broad distribution patterns of the type.

Model results were reviewed by experts from TNC, NHFG, and NHNHB, who agreed that the broad patterns depicted by the model align with reasonable expectations. No ground truthing was conducted.

1.7 Sources of Information

The Appalachian oak pine map was developed based on expert input from scientists from the NHNHB, NHFG, and the New Hampshire Chapter of The Nature Conservancy. The results were reviewed by additional scientists from NHFG and the Audubon Society of New Hampshire. A variety of GIS data was used to generate the map including elevation data from the United States Geological Survey, landform data from The Nature Conservancy's eastern regional office, landcover data from the New Hampshire Landcover Assessment, and soils data from the Natural Resource Conservation Service, among others.

1.8 Extent and Quality of Data

The Appalachian oak pine habitat map is a depiction of broad landscape patterns with limited fine-scale accuracy. Additional refinements will likely be necessary based on ground truthing of the existing map. The Natural Resource Conservation Service provided a table of soil series that were believed to be strongly correlated with Appalachian oak pine and other forest types (Homer 2005). Soil series were provided by ecoregional subsection and elevation ranges. There was considerable overlap between series outlined for Appalachian oak pine and other forest types, especially hemlock-hardwood-pine. The transition between Appalachian oak pine and hemlock-hardwood-pine

was especially difficult to delineate, as disturbance is a driving factor in the distribution of Appalachian oak pine. The soil series considered to be most strongly correlated with Appalachian oak pine that did not overlap with hemlock-hardwood-pine were used in mapping Appalachian oak pine. Additional review of soils data, as well as land use history and paleoecology information, are necessary for future iterations.

1.9 Distribution Research

Additional fieldwork is needed to evaluate correlations between soil series and forest type as outlined in Homer (2005). County soil surveys outline soils suitable for forestry from an economic perspective. However, little has been done to evaluate soils from an ecological perspective (e.g., if left unmanaged, an area with a particular soil would eventually succeed to Appalachian oak pine forest).
Fieldwork is also needed to ground truth the Appalachian oak pine map.
Research is needed to identify human-created disturbance regimes that can maintain and regenerate Appalachian oak pine forest.

Element 2: Species/Habitat Condition

2.1 Scale

County

2.2 Relative Health of Populations

An approximately 5% decrease in forest area occurred between 1992 and 1993 and 2001 in the 4-county area where approximately 90% of New Hampshire's potential Appalachian oak pine forest occurs. An additional approximately 5% decrease is projected to occur between 2001 and 2025 (calculated from data in SPNHF 2005).

2.4 Relative Quality of Habitat Patches

Analysis pending

2.5 Habitat Patch Protection Status

Approximately 10% of potential Appalachian oak pine forest in the 4-county area where approximately 90% of this forest type occurs is in conservation ownership (calculated from TNC data). Approximately 14% of this type occurs on lands with some form of conservation protection (calculated from NHFG data).

2.6 Habitat Management Status

Approximately 25% of the 4-county area in which approximately 90% of potential Appalachian oak pine forest area occurs is in certified Tree Farms (calculated from TNC data and data in Thorne and Sundquist 2001).

2.7 Sources of Information

See 1.7

2.8 Extent and Quality of Data

See 1.8 regarding extent and quality of data associated with the TNC matrix forest map. Tree farm data from Thorne and Sundquist 2001 are based on a New Hampshire Tree Farm program database issued in August 2000. Data regarding changes in forest area from SPNHF 2005 include information from the New Hampshire Land Cover Assessment, 2001 and results of predictive modeling.

2.9 Condition Assessment Research

- Research is needed to determine the extent of this forest type that occurs in large unfragmented blocks.
- Research is needed to determine the age class distribution of this forest type on the landscape.

Element 3: Species and Habitat Threat Assessment

3.1.1 Transportation Infrastructure

(A) Exposure Pathway
Transportation infrastructure fragments forest blocks, creating edge effects from light penetration and exposure to wind and pollutants such as road salt and hydrocarbons. Transportation infrastructure and its use by vehicles also create dispersal barriers, edge effects, and increased mortality for matrix forest wildlife (Forman et al. 2003).

(B) Direct Evidence
Large carnivores may be unable to maintain sustainable populations in landscapes with road densities exceeding 1 mi/ mi^2 (Forman and Alexander 1998). Roads affect forest and habitat conditions well beyond the actual edge of the forest (Ranney et al. 1981). Roads can negatively affect landscape permeability for black bears, bobcats, and lynx (Forman et al. 2003).

3.1.2. Development (Habitat Loss and Conversion)

(A) Exposure Pathway
Development reduces matrix forest habitat by converting natural forest to landscaped lawns and impermeable surfaces (e.g., buildings, roads). Development also contributes to forest fragmentation by directly reducing habitat, increasing traffic on existing roads, and requiring construction of new transportation infrastructure.

(B) Direct Evidence
A study of 10 New Hampshire communities found that their populations increased by an average of 70.9% (range 9.7 to 189.7%) between 1974 and 1992, while developed land increased by an average of 137.2%. In the community with 9.7% population growth, developed land increased by 15.9% (New Hampshire Office of State Planning (NHOSP) 2000).

3.1.3. Development (Land Use Planning)

(A) Exposure Pathway
In New Hampshire, land use decisions are made at the municipal scale by volunteer planning boards with little or no training in natural resource issues. In cities and some of the larger towns, professional planning staff evaluate proposed developments and provide input to the planning board, but this is the exception rather than the rule. Most professional planners lack training in ecology or natural resources. Decisions are typically based on engineering and aesthetic considerations, with no recognition of direct or cumulative impacts on the underlying ecological functions of the affected lands or on impacts to wildlife habitat.

(B) Direct Evidence
A Growth Management Advisory Committee convened by the New HOSP in 1999 concluded that:

- Impacts of growth and development are cumulative over decades
- Development in New Hampshire has occurred incrementally, resulting in fragmentation and loss of important and environmentally sensitive areas, including forestlands and wildlife habitat
- Communities seldom evaluate the potential impacts of their zoning ordinance or land use regulations (NHOSP 2000)

3.1.5 Altered Natural Disturbance (Succession)

(A) Exposure Pathway
Extinction of the passenger pigeon, fire suppression, development, and accompanying land-use policies have essentially eliminated the major historical natural disturbances for this forest type. Parcelization and extensive residential development now preclude forest management in much of New Hampshire's Appalachian oak pine forest. Habitat for wildlife species requiring early successional stages of this forest type has been substantially reduced.

(B) Direct Evidence
Forest inventory data for New Hampshire show major deficits in the 2-inch diameter class for hickory and the 4-inch diameter class for white oaks (Miles 2005).

3.2 Sources of Information

Threat information was derived from a work session with forestry professionals and stakeholders, available data, published literature, and personal experience.

3.3 Extent and Quality of Data

Threats to Appalachian oak pine forest resulting directly or indirectly from land conversion and development are well documented.

3.4 Threat Assessment Research

The major threats are adequately documented. Re-

search should be directed to condition assessment and conservation actions.

Element 4: Conservation Actions

4.1.1 Incorporate Habitat Conservation into Local Land Use Planning

See Strategies: Local Regulation and Policy

4.1.2 Advise Conservation Commissions and Open Space Committees

See Strategies: Local Regulation and Policy, Education and Outreach

4.1.3 Promote Role of the Regional Planning Commissions in Landscape-Scale Conservation

See Strategies: Local Regulation and Policy

4.1.4 Protect unfragmented blocks and other key wildlife habitats

See Strategies: Land Protection

4.1.5 Develop a comprehensive land protection support program

See Strategies: Land Protection

4.1.6 Advocate adoption of sustainable forestry

See Strategies: Education and Outreach

4.2 Conservation Action Research

Research is needed to provide a sound scientific basis for new tools to help municipalities maintain large forest blocks and significant wildlife habitat in the face of development. Such research could include:

- Road noise effects on forest bird distribution and breeding status
- Behavior and land use of mesocarnivores in relation to development and road densities
- Bear use of mast stands relative to proximity of development
- Effects of residential lot sizes on habitat suitability and landscape permeability for selected wildlife species

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HABITAT PROFILE

Pine Barrens

Associated Species: frosted elfin butterfly (Callophyrus [Incisalia] irus), Karner blue butterfly (Lycaeides melissa samuelis), Persius duskywing (Erynnis persius persius), Sleepy duskywing (Erynnis brizo brizo), wild indigo duskywing (Erynnis baptisiae), barrens xylotype (Xylotype capex), broad-lined catophyrra (Catopyrrha coloraria), cora moth (Cerma cora), Phyllira tiger moth (Grammia phyllira), pine barrens itame (Itame sp 1), pine barrens zanclognatha moth (Zanclognatha martha), pine pinion moth (Lithophane lipida lipida), black racer (Coluber constrictor), eastern hognose snake (Heterodon platirhinos), smooth green snake (Liocloronophis vernalis), eastern box turtle (Terrapene carolina), Fowler's toad (Bufo fowleri), common nighthawk (Chordeiles minor), eastern towhee (Pipilo erythrophthalmus), whip-poor-will (Caprimulgus vociferus), New England cottontail (Sylvilagus transitionalis).
Global Rank: Globally Not Ranked
State Rank: Pitch pine-scrub oak woodland (S1S2)
Author: Goulet, Celine
Affiliation: New Hampshire Fish and Game

Element 1: Distribution and Habitat

1.1 Habitat Description

Pine barrens are early-successional habitats occurring on northeastern coastal sand plains or on sandy, glacial outwash deposits of major river valleys (Howard et al 2005). Soils are acidic, droughty, nutrient-poor, and excessively well-drained. In New Hampshire, pine barrens are dominated by pitch pine (Pinus rigida) and scrub oak (Quercus ilicifolia) and form a matrix of dense scrub oak thickets and heath barrens interspersed with pockets of pitch pine forest and grassy openings (Sperduto and Nichols 2004). This structural and compositional heterogeneity is in constant flux, a process maintained by frequent disturbances such as wildfire. Fires occur naturally and regularly in pine barrens, with lightning serving as the primary ignition source (Howard et al 2005). These fires are able to spread rapidly across the community's flat expanse of dry, fire-prone vegetation (Howard et al 2005). Lee sides of habitat features, such as eskers, rivers, and slopes act as natural firebreaks, creating variation in species composition as well as vegetational age distributions (Howard et al 2005).

The two variants of the pitch pine-scrub oak woodland community occurring in New Hampshire are the Merrimack Valley variant and the Ossipee variant (Sperduto and Nichols 2004). The Merrimack Valley variant occurs in the Concord pine barrens and occupies Windsor sandy loams and Hinckley cobbly sandy loams (VanLuven 1994), both deposits of the post-glacial Lake Merrimack (Sperduto and Nichols 2004). This variant is characterized by a high diversity of both common and rare vascular plants, including blue lupine (Lupinus perennis), blunt-leaved milkweed (Asclepias amplexicaulis), and New Jersey tea (Ceanothus americanus) (Sperduto and Nichols 2004). The Ossipee variant occurs in the Ossipee pine barrens, occupying deep outwash deposits between Ossipee and Silver Lake (Sperduto and Nichols 2004). Less diverse than the southern variant, the Ossipee variant is instead associated with more northern plant species such as bearberry (Arctostaphylos uva-ursi), three-toothed cinquefoil (Potentilla tridentata), and savin-leaved clubmoss (Diphasiastrum sabinifolium) (Sperduto and Nichols 2004).

1.2 Justification

Pine barrens are among the most imperiled communities in the world (Raleigh et al 2003). Throughout

the thousands of years of their existence, pitch pine-scrub oak woodlands have significantly contributed to the biological diversity of the northeast (Howard et al 2005). These communities support a suite of species that are regionally and globally rare (Howard et al 2005). Of the rare fauna occurring within them, the largest assemblage is Lepidoptera, as demonstrated in New Hampshire (VanLuven 1994). Of the 726 Lepidoptera species collected in the Concord pine barrens, 4 are globally imperiled and 37 are rare to the state, including the federally and state endangered Karner blue butterfly (Lycaeides melissa samuelis) as well as the state endangered frosted elfin (Callophyrus [Incisalia] irus) and persius duskywing skipper (Erynnis persius persius) (VanLuven 1994, Chandler 2001, Sperduto and Nichols 2004). A large proportion of these Lepidopteran fauna are exclusively dependent on blue lupine and other plants restricted to pine barrens (Sperduto and Nichols 2004). The Ossipee pine barrens lacks the level of Lepidopteran diversity found in its southern counterpart, although it does support the only New England occurrences of the pine pinion moth (Lithophane lepida lepida), pink-edged sulphur (Colias interior), and the noctuoid moth Xylena thoracica (Sperduto and Nichols 2004).

Pine barren communities also serve a role in the life histories of a number of vertebrates as well, a relationship based on edaphic and structural features, not host plant specificity as attributed to Lepidopteran endemism (Howard et al 2005). Such species include approximately 50% of northeastern birds, almost 60% of northeastern mammals, and a number of reptiles and amphibians (Howard et al 2005).

Historically, pine barrens provided the array of distinctive habitat features required by their associated fauna (Howard et al 2005). However, with increased fire suppression during the last half-century, this habitat's natural course of succession was severely disrupted (Howard 2003). Reduced intensity and frequency of natural disturbance caused the pitch pine-scrub oak woodland to advance into a closed pitch pine-scrub oak forest, eliminating structural elements critical to the long-term viability of indigenous populations (Raleigh et al 2003, Howard et al 2005). Moreover, urban development has added to the effects of fire suppression, further reducing the extent of pitch pine-scrub oak woodland communities (Howard et al 2005). The result has been significant habitat loss and fragmentation in systems that were historically large and contiguous (Howard et al 2005).

3.3 Protection and Regulatory Status:

Federal

National Plant Protection Act: promotes the preservation of blue lupine, blunt-leaved milkweed, and golden heather (Hudsonia ericoides) on state lands, but provides no protection on private property (VanLuven 1994)

Local

Concord Municipal Airport Development and Conservation Management Agreement: restricts development within designated conservation zones, authorizes the New Hampshire Fish and Game Department, the Department of Resources and Economic Development, the New Hampshire Army National Guard, and the United States Fish and Wildlife Service to undertake management actions to provide and enhance essential habitat for federally and state listed threatened and endangered species of Lepidoptera.

1.4 Population and Habitat Distribution

Pine barrens are predominantly restricted to New Jersey, though regionally rare examples occur in Maine, New Hampshire, Massachusetts, Pennsylvania, and New York (Howard 2003). In New Hampshire, this habitat is limited to the Sebago-Ossipee and Gulf of Maine Coastal Plain ecoregion subsections (Sperduto and Nichols 2004). The Ossipee pine barrens is located within the towns of Ossipee, Tamworth, Freedom, Madison, and Effingham, at an elevation range of 137-152m (Howard 2003). Its estimated historic extent encompassed over 2,833 ha (7,000 ac), which has since been reduced to about 1,214 ha (3,000 ac) (Howard 2003). The Concord pine barrens occurs within the city of Concord at an elevation of 105m. Its distribution once covered approximately 1,821 ha (4,500 ac) along the Merrimack River from Concord south to Nashua, of which only 227 ha (563 ac) remain today (VanLuven 1994).

1.5 Town Distribution Map

See attached.

1.6 Habitat Map

Potential pine barrens habitat was mapped using known pine barrens occurrences (New Hampshire Natural Heritage Bureau 2005). Six variables were measured for pixels within known occurrences: elevation, slope, landcover, drainage, texture, and a composite index of drainage and texture indicating the location of the pixel relative to large, contiguous areas of appropriate soils conducive to fire spread. For each variable, the range of values that encompassed 85-93% (depending on the variable) of the pixels was selected. Throughout the state, pixels that fell within these value ranges for all six variables were selected as potential pine barrens habitat. Known habitat patches as well as historically known patches were then added to the map.

Limitations of Data

The pine barrens map was heavily dependent on the accuracy of soils data and elevation data. While there are some errors in the elevation data, there are likely to be more errors in the soils data. County soil surveys often do not show small inclusions of different soil types within larger polygons. In addition, digital county soil surveys are not available for Belknap and Merrimack Counties or the White Mountains, and drainage and texture data is absent from some polygons of Coos County. For these areas, the STATSGO data set was used (Natural Resources Conservation Service 1994). STATSGO is a map of soil data at a much coarser scale than county soil surveys, and thus is much more prone to error at the fine scales required for accurate habitat maps. Thus, the pine barrens map will be most inaccurate in these areas.

1.7 Sources of Information

Information on pine barrens distribution and status was collected from habitat management plans, technical field reports, agency data, and scientific journals.

1.8 Extent and Quality of Data

The pine barrens habitat and associated fauna have been studied extensively in New Hampshire and adjacent states. Although life history data on certain species could be improved, general habitat associations, particularly of Lepidoptera, are well known. See limitations in section 1.6 above.

1.9 Distribution Research

Areas requiring further research include historical distribution, geologic and ecological processes contributing to the formation of pitch pine-scrub oak woodland communities, distribution and condition of populations of pine barrens-dependent fauna, and the role of land-use history in maintaining and/or promoting the establishment of pitch pine-scrub oak woodland habitat.

Element 2: Species/Habitat Condition

2.1 Scale

2.2 Relative Health of Populations

Good examples of pitch pine-scrub oak woodlands in New Hampshire occur in the Concord pine barrens (Concord) and the Ossipee pine barrens, (Madison, Ossipee, and Tamworth), with the Ossipee pine barrens being considered the largest and most pristine pitch pine-scrub oak woodland community in the state (Howard 2003, Sperduto and Nichols 2004). A small, heavily managed population of Karner blue butterflies exists in the Concord pine barrens, and populations of other lepidopteran species associated with this habitat are found in both the Concord and Ossipee pine barrens.

3.3 Population Management Status

Not required for habitat profiles.

2.4 Relative Quality of Habitat Patches

The Concord pine barrens are extremely fragmented. Mean patch size of existing pine barrens in the Concord area is 10.2ha, and of predicted patches is 2.9ha. Patches in the Ossipee area are much larger; current pine barrens patches average 44.2ha, while predicted patches are still small, averaging 2.4ha. Predicted patches elsewhere in the state are similarly quite small. The pine barrens at the Concord airport are surrounded by less than 40% unaltered land within 250m. In contrast, the pine barrens in the Ossipee

region have from 67-93% unaltered land within 250m. Road density, however, is higher in the Ossipee barrens.

Although the Concord pine barrens are more fragmented and developed, they have the highest known density of rare plants and animals relative to other pine barrens in New Hampshire. Thus, the landscape context of the Ossipee barrens is more favorable, but the biodiversity of the Concord barrens is of critical importance.

2.5 Habitat Patch Protection Status

Approximately 227 ha (560 ac) of the remnant Concord pine barrens is protected through the Concord Municipal Airport Development and Conservation Management Agreement (2000). The majority of the land (210 ha) occurs on the Concord Municipal Airport and is owned by the city of Concord. Eight conservation zones made up of 57 management units have been established on this land, with management working towards enhancing and restoring the pitch pine-scrub oak woodland community, a critical habitat for the Karner blue butterfly as well as a suite of other rare species. Of the remaining land, 11 ha (27 ac) is held as a conservation easement granted to the United States Fish and Wildlife Service. The easement is open to the public but wheeled vehicles are forbidden. The 4 ha (10 ac) of the historic main site, located along a powerline right-of-way, is privately owned and maintained by Public Service of New Hampshire.

Thirty percent of the existing Ossipee pine barrens are in fee ownership protection. Twelve hundred acres of pitch pine is on protected land, within a larger contiguous area of 5000 acres, owned by the Nature Conservancy. Additional small parcels are owned by the towns of Freedom and Madison.

2.6 Habitat Management Status

Current habitat management and restoration techniques used in the Concord pine barrens include native plant propagation, vegetation management using specialized mowers and feller bunchers, and prescribed fire. These techniques are used to create sandy and herbaceous openings within a matrix of heath, scrub-shrublands, and woodlands. Habitat monitoring is completed before and after management implementation. The goal is to create a shifting mix of native grassland, shrubland, and woodland features (Fuller et al. 2003).

Similarly, The Nature Conservancy is currently exploring various management options to implement within the Ossipee pine barrens, including mechanical treatments to create firebreaks and remove unwanted vegetation, as well as some level of prescribed burning (Howard 2003). The intent is to maintain, enhance, and restore ecological processes vital to the overall function of the pitch pine-scrub oak woodland community (Raleigh et al 2003).

2.7 Sources of Information

Pitch pine-scrub oak woodland habitat protection and management information was obtained from habitat management plans, agency agreements, and personal communication.

2.8 Extent and Quality of Data

The GIS data used to create the predicted pine barrens map does contain some errors, primarily in the soil data. The map is less accurate in Belknap and Merrimack Counties, the White Mountains, and small portions of Coos County, due to a lack of fine scale soil data. The delineation of known pine barrens and the conservation data are fairly accurate.

2.9 Condition Assessment Research

Predicted pine barrens patches need to be verified on the ground as existing pine barrens or potential patches for restoration. Evaluation of the suitability and feasibility of restoration in these patches is necessary.

Element 3: Species and Habitat Threat Assessment

1.1.1 Development (Habitat Loss and Conversion)

(A) Exposure Pathway:

It has been asserted that one of the major threats to pine barrens is habitat loss, primarily as a result of development (Howard et al 2005). Habitat features associated with these communities, such as level terrain, sandy soils, high stability, high perme-

ability, and low compaction, make them optimal for commercial and residential development. Some species of vertebrates that use pine barrens can travel significant distances, requiring large blocks of contiguous habitat. A half-century of constant growth has resulted in a severe loss of habitat in communities that were historically large and contiguous (Howard et al 2005).

(B) Evidence
Throughout the northeast, nearly half of all known pitch pine-scrub oak woodland communities have been lost as a result of development and fire suppression (Jordan et al 2003). New Hampshire had at one time supported 4 such communities, including the Nashua, Manchester, Concord, and Ossipee pine barrens (The Nature Conservancy 2004). As in the remainder of the region, increased development and urban sprawl throughout the state drastically reduced the extent of these communities. Both the Nashua and Manchester pine barrens have been entirely altered, while a mere 10% of the historic Concord Pine Barrens and 30% of the Ossipee remain today (Helmbolt and Amaral 1994, The Nature Conservancy 2004).

3.1.2 Altered Natural Disturbance (Fire Suppression)

(A) Exposure Pathway
Due to the xeric soil, flammable pine litter, and flat terrain on which they occur, pine barrens have been subject to frequent wildfires (Howard 2003). The absence of such disturbance, combined with the natural processes associated with succession, have caused the community composition of pitch pine-scrub oak woodlands to shift into a closed-canopy forest dominated by fire intolerant hardwoods (Howard et al 2005). Additionally, without a regular fire regime, fuels have accumulated, increasing the risk of high intensity wildfires inappropriate to pine barrens regeneration

(B) Evidence
In the northeast, pitch pine-scrub oak woodland communities require periodic fire to persist (Wagner et al 2003). Fire suppression has been a major factor contributing to the decline of disturbance-dependent habitats throughout the northeast (Raleigh 2003). In the last half-century, natural fire disturbance has been eliminated from both the Concord and Ossipee pine barrens systems, leading to a significant shift in community composition and structure (VanLuven 1994, Howard 2003). In Concord, the distinguishing mosaic of grassy openings, heath barrens, scrub oak thickets, and pitch pine woodlands no longer exists, as it has been replaced by medium-fire tolerant white pine and fire intolerant hardwoods (VanLuven 1994). Similarly, white pine and fire-intolerant hardwoods have substantially increased over the last 50 years in the Ossipee pine barrens and are predicted to soon be the dominant canopy species (Howard et al 2005).

3.1.3 Development (Fragmentation)

(A) Exposure Pathway
Continuity of pine barren communities has been severely interrupted by infrastructure and road development. Currently, most communities are fragmented into relatively small habitat patches (Howard et al 2005). Such fragmentation serves to alter both microclimatic conditions and biogeographical distribution of pine barrens (Saunders et al 1991). As a result, total available habitat is reduced, ecological processes are disrupted, edge effects are increased, and the intrusion of invasive species is promoted, all of which serve to jeopardize overall community composition and structure (Saunders et al 1991, VanLuven 1994, Howard et al 2005).

(B) Evidence
Fragmentation of pine barrens on the modern landscape has had far reaching effects, altering both this community's ecological function and its physical environment. Of the affected ecological processes, the interference with a natural fire regime has had the greatest impact. Without large, continuous areas of unfragmented habitat, the occurrence of natural fires of sufficient frequency, intensity, and extent is reduced (Wagner et al 2003). Such reduction hinders pitch pine-scrub oak woodland vegetation recruitment, thereby affording the introduction of new, unnatural elements into the biota (Webb 2000, Howard et al 2005). Additionally, fragmentation creates artificial edges which have been shown to alter microclimate by elevating light, decreasing humidity, increasing wind exposure, and introducing airborne materials such as dust, further disrupting natural eco-

logical processes and facilitating the establishment of invasive species (Saunders et al 1991, Webb 2000).

3.1.4 Light Pollution

(A) Exposure Pathway:
Light pollution has adverse effects on much of the insect fauna associated with pine barrens (Frank 1988). Lepidopterists have long attributed population declines to light pollution, especially in moths (Frank 1988). Artificial lighting disturbs flight, navigation, vision, migration, dispersal, oviposition, mating, feeding, and crypsis in some moths (Frank 1988). It also increases their susceptibility to predation by birds, bats, and spiders (Frank 1988). The result may be either changes to behavioral patterns or an alteration in species composition of moths inhabiting illuminated environments (Frank 1988).

(B) Evidence:
Outdoor lighting has sharply increased over the last half century (Frank 1988). It has been suggested that declines in North American moth populations, especially northeastern Saturniids, is a direct result of light pollution (Frank 1988). The impacts of light pollution are amplified in small populations threatened by other disturbances, particularly in habitats fragmented by urban development (Frank 1988).

3.2 Sources of Information

Information on threats affecting pine barrens was acquired from the Concord Pine Barrens Habitat Management Plan, scientific journal articles, and personal communications and observations.

3.3 Extent and Quality of Data

Much study has been conducted regarding threats impacting pine barrens habitat. This information is documented in management and conservation plans as well as scientific journals.

3.4 Threat Assessment Research

Community-level effects of fire suppression and fragmentation should be further investigated. Research should focus on vegetation responses to fire suppression based on specific land-use and ecological histories, effects of microclimatic alterations on community composition, and habitat patch isolation. In addition, research should be conducted regarding the long-term effects light pollution has on insect populations and species composition, especially in reference to species inhabiting fragmented communities. Further research on invertebrate – host plant relationships and life cycles will aid in determining the influence of these threats on various species.

Element 4: Conservation Actions

4.1.1 Habitat Management

Category: Restoration and Management

(A) List of Direct Threats Affected
Habitat Loss, Habitat Fragmentation, Succession

(B) Justification:
1) Habitat management will increase the distribution and abundance of pine barrens within their existing and historical range by reverting closed-canopy stands to an early-successional structure. Standard habitat management techniques including forestry, fire, and herbicide have well-documented efficacy in reducing the cover of canopy-forming, shade-tolerant, and fire-sensitive species.
2) Early-successional plant species abundance increases in response to a broad range of vegetation management techniques (Smallidge et al. 1996). Management simulates natural and anthropogenic disturbance, creating areas of open or semi-open habitat interspersed with closed woodlands. In addition to maintaining open habitat structure, management releases scarce nutrients, exposes bare mineral soil, and stimulates flowering, germination, and seedling establishment of fire-adapted species, while serving to promote and maintain connectivity across the landscape (Wagner et al 2003). This continually changing heterogeneous landscape satisfies the microhabitat needs of a suite of indigenous species.
3) Habitat management is necessary to prevent the loss of protected habitat to succession, but is not adequate to secure unprotected remnants and buffer existing conservation land from development.

4) Restorative management intensity is high in the short-term, but can be reduced to a sustainable maintenance level in the long-term. Depending upon the intensity of management, beneficial responses can be observed in 0-3 years, and maintained with management on a 5-10 year rotation.
5) Pine barren vegetation can be controlled and maximized by adjusting the frequency and intensity of habitat management to modify current densities of canopy species and scrub oak. The prescription may be adapted to guide management in new areas.

(C) Conservation Performance Objective
The habitat management performance objective is to create a matrix of interconnected grasslands, shrublands, and woodlands by manipulating the densities of woody species in key vegetative strata. Progress toward target levels (i.e., reduction in canopy and shrub strata) will indicate the performance of habitat management.

(D) Performance Monitoring
Densities of woody species will be monitored as prescribed in Fuller et al. (2003) prior to implementation of management and in subsequent years.

(E) Ecological Response Objective
The habitat management response objective is to increase the densities of pitch pine-scrub oak woodland plant species in proportion to their associated early successional vegetative strata. Target levels for management units by strata and species are described in Fuller et al. (2003). Progress toward target levels (i.e., increase in density of pitch pine-scrub oak woodland plant species in proportion to sand, herbaceous, and heath strata) will indicate a beneficial response to habitat management.

(F) Response Monitoring
The density of key habitat plants will be monitored as prescribed in existing management plans such as Fuller et al. (2003) prior to implementation of management and in subsequent years.

(G) Implementation:
The New Hampshire Fish and Game Department, the New Hampshire Department of Resources and Economic Development, the New Hampshire Army National Guard, the United States Fish and Wildlife Service, the Federal Aviation Administration, and the city of Concord will cooperate to implement habitat management as per the Concord Municipal Airport Development and Conservation Management Agreement (2000) and the Management Plan (Fuller et al., 2003) under the guidance of the management team.
The Nature Conservancy has also developed a management plan for the Ossipee pine barrens which mechanical thinning, constructing fire breaks, and some prescribed burns (Jeff Lougee, personal communication).
Most management of pine barrens to this point has focused on Karner blue butterflies. Management procedures for other rare species should also be developed.

(H) Feasibility:
These restoration plans have successfully been implemented in the Concord pine barrens, and have begun to be implemented in the Ossipee pine barrens. Future feasibility is limited only by funding, which for the Concord site is secure through 2012.

4.1.2 Backyard Habitat Program

Category: Education and Outreach

(A) List of Direct Threats Affected
Habitat loss, Fragmentation, Succession, Isolation

(B) Justification:
1) Engaging the public to propagate pine barrens habitat plants on public and private land, and encouraging landscape professionals to adopt native plant landscaping will increase the availability of native plants for pine barrens-dependent species and provide stepping-stone habitat in highly fragmented areas.
2) Karner blue butterflies have been documented ovipositing and feeding on blue lupine planted by schoolchildren. Studies have shown that Karner blue butterflies use commercial and residential landscape plants to augment 'natural' habitat. Other species may also have similar responses to cultivated

host plants.

3) Habitat restoration efforts are currently restricted to Concord, New Hampshire. Similar strategies could be implemented in other pine barrens throughout the state. Efforts will be targeted towards decision-makers, professionals, landowners, and school children.
4) Habitat restoration is an ongoing process and the importance of this work needs to be addressed in both the short and long term. Students that plant blue lupine today will provide an immediate benefit, and may support recovery efforts as adults.
5) Education and outreach can be molded to meet different target audiences (landowners vs. school children) or habitat areas (private land vs. public land), and evolve as new techniques are developed. Content of educational materials can be geared towards specific threats to pine barren habitat.

(C) Conservation Performance Objectives:
In the Concord pine barrens, increase the number of blue lupine plants planted by schoolchildren and other volunteers to more than 500 plants per year for the next 5 years. Within 5 years, increase the proportion of landowners adopting pine barrens-friendly management and landscaping practices within the Concord pine barrens area to more than one-half for new developments and existing buildings within the potential habitat area. Increase volunteer participation in restoration activities to more than 20 per year for the next 5 years.

(D) Performance Monitoring:
Performance may be monitored via: documentation of the number of blue lupine plants planted each year by school children and other volunteers; random surveys of landowners to determine current land management practices; documenting the number of approved development plans that adopt pine barrens-friendly landscaping and management practices; and documenting the number of competent and reliable volunteers.

(E) Ecological Response Objective:
The desired ecological response is to increase the availability of blue lupine and nectar plants within and between habitat restoration areas. Successful education and outreach will be indicated by pine barrens lepidoptera using plants propagated by school children and using developed landscapes managed under pine barrens-friendly programs.

(F) Response Monitoring:
The use of plants propagated by school children will be documented during structured pine barrens population monitoring as described in the Concord pine barrens management plan (Fuller et al. 2003). As suitable plants are cultivated in the landscape surrounding restoration areas, monitoring will be adapted (with landowner permission) to document the movement of Karner blue butterfly and other pine barrens species through habitat between restoration areas.

(G) Implementation:
Hire education and outreach staff to:
Target nursery operators, landscape professionals and contractors to raise awareness of native plants, receive training on propagation, develop a supply of native plants, and advocate native plant landscaping in the community. Identify a training structure and present information at landscaping association meetings. Implement green landscaping certification.
Target landowners to disseminate educational materials, raise awareness, cultivate a demand for native plants, and implement landowner incentives. Train landowners to preserve existing native plant resources and adopt native plant landscaping. Encourage land managers to adopt Best Management Practices that incorporate native plant restoration.
Give presentations to the community and create informational materials such as kiosks, brochures, demonstration sites, etc.

(H) Feasibility
The limiting factor to educational implementation is funding and personnel resources. The New Hampshire Fish and Game Department is limited in staff and funding to carry out restoration and recovery work. More integration with the Public Affairs Division is needed to focus on education and outreach. Resources must be made available for developing education materials and training. The National Wildlife

Federation has assisted with blue lupine planting by school children and will continue to do so.

4.1.3 Artificial Light Reduction

Category: Education and Outreach

(A) List of Direct Threats Affected
Light Pollution

(B) Justification:

1) Reducing the amount of light pollution in pine barrens habitat will remove external artificial light that can compromise the behavior of nocturnal Lepidoptera.

2) Nocturnal pine barrens Lepidoptera will be better able to continue their life cycles in natural conditions without light pollution.

3) Light reduction would only be implemented in areas where nocturnal Lepidoptera are demonstrated to occur.

4) Light reduction would only be implemented during those times of the year when target Lepidoptera are active.

5) If new occurrences of nocturnal Lepidoptera are found, light reduction can be implemented in those areas as well.

(C) Conservation Performance Objective
The performance objective will be a reduction in artificial light to levels that do not affect nocturnal Lepidoptera, as demonstrated in available literature.

(D) Performance Monitoring
Reduction in light will be monitored by periodic site visits. Residences and commercial establishments that do not conform to acceptable light levels will be noted.

(E) Ecological Response Objective
Nocturnal activity of target Lepidoptera will be uninterrupted and behavior will not change from expected levels based on available literature. Populations of target species will not decline.

(F) Response Monitoring
Visits to known nocturnal Lepidoptera sites in areas of restricted artificial light will be made. Samples of target species will be taken and populations monitored. Nondeclining populations will indicate an effective ecological response. Observations of activity in target species will be used to determine if normal behavior is occurring.

(G) Implementation
Artificial light-free reserves will be established, such as sheltered hollows shielded from lighting (Frank 1988). To reduce lighting impact in habitats already exposed to lamps, low-pressure sodium lamps may replace other lamps when illumination is essential (Frank 1988). Filters to block ultraviolet light may be installed over mercury vapor lamps, and shields may be placed around lamps to block stray light (Frank 1988). Landowners will be presented with information and encouraged to use alternative lighting as outlined in Frank 1988.

(H) Feasibility
Staff time and funding will be necessary to implement this strategy. Effective light reduction will depend on the willingness of landowners to adopt light reduction practices.

4.1.4 Habitat Restoration

Category: Habitat Management

(A) List of Direct Threats Affected
Habitat loss, Fragmentation, Succession, Isolation

(B) Justification:

1) Restoring habitats that are no longer pine barrens to a pine barrens state will increase the amount of pine barrens habitat available, thus increasing connectivity between patches, reducing fragmentation, and mitigating habitat loss.
2) Increasing the amount and connectivity of pine barrens communities will provide more suitable habitat for pine barrens species and more opportunity for fire spread and seed dispersal, thus ensuring the continuity of pine barrens.
3) Pine barrens habitats are rare in the northeast; thus, any restoration of habitat to a pine barrens state will increase the spatial distribution of this habitat throughout the region.
4) Pine barrens habitats are becoming increasingly rare. Immediate restoration of potential habitat is needed to prevent extinction of local popula-

tions of pine barrens species.

5) As new potential sites become available, restoration can be implemented and adapted to those sites. Restoration measures can be changed to include the most effective methods as more information is gained.

(C) Conservation Performance Objective:
The objective is to increase the amount of pine barrens vegetation throughout its historical range.

(D) Performance Monitoring:
Performance will be monitored by site visits before restoration and at intervals afterwards to determine if pine barrens vegetation is increasing and surving at restored sites.

(E) Ecological Response Objective:
The objective is to create habitat suitable for pine barrens fauna.

(F) Response Monitoring:
Response will be monitored by site visits to survey for pine barrens fauna. The use of restored sites by pine barrens fauna, as well as the existence of pine barrens vegetation, will indicate successful restoration.

(G) Implementation:
Potential sites for restoration will be selected, with a focus on historical sites where remnant patches may occur. Emphasis will be primarily on open, bare sites and secondarily on sites occupied by white pine. Open sites will be seeded with pine barrens vegetation and monitored. Upon successful generation and growth of these species, typical pine barrens management will be implemented. Sites occupied by white pine will be cut and an appropriate fire regime and other pine barrens management strategies will be implemented. Sites will be monitored for the growth of pine barrens vegetation.

(H) Feasibility:
Site restoration will require staff and funding. Existing management plans could be adapted to incorporate restoration. Cooperation with willing landowners will be necessary for restoration on privately owned sites.

4.2 Conservation Action Research

Because each geographically isolated pitch pine-scrub oak woodland community has been subject to a unique combination of ecological and anthropogenic influences, knowledge of such factors is critical to the design of management plans (Howard et al 2005). In addition, research should be conducted regarding vegetational responses to the various management techniques, intensities, and frequencies. Focus should be specifically on key pitch pine-scrub oak woodland species.

Element 5: References

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Element 5.2 Data Sources

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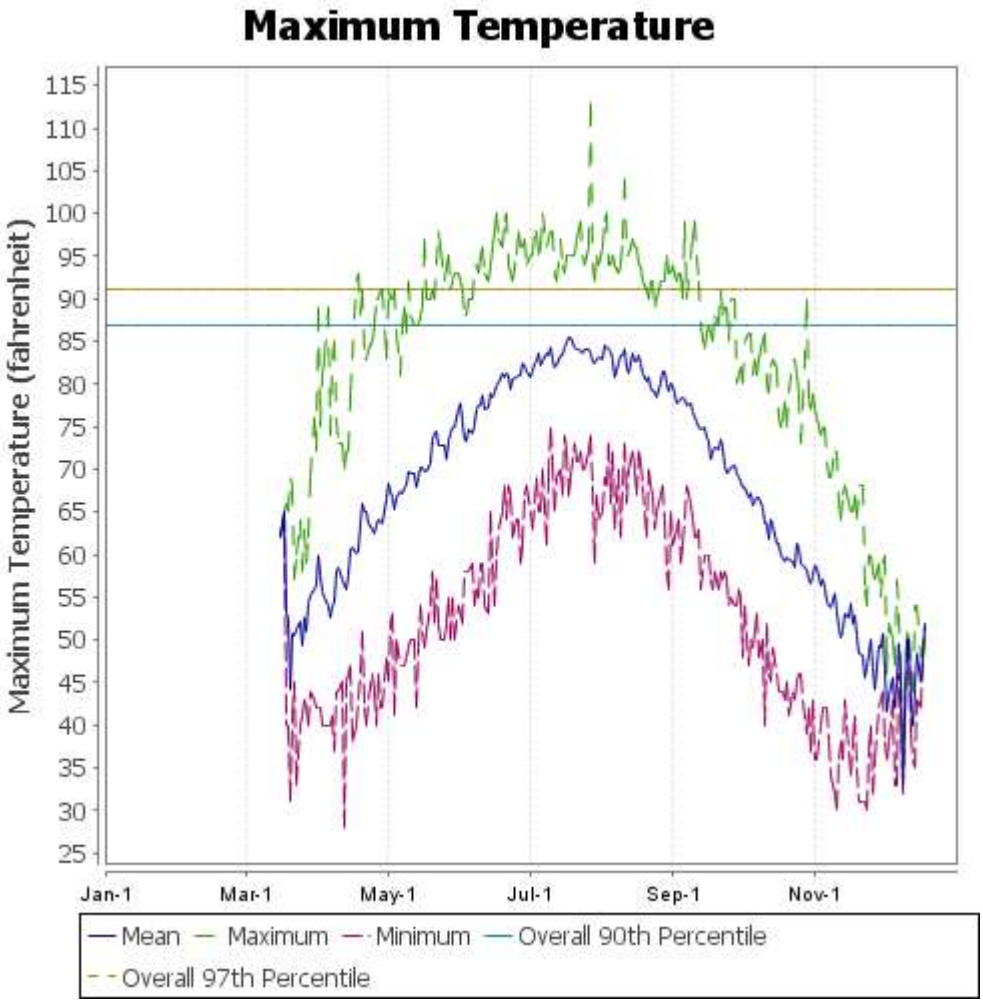
Appendix B – Fire Family Plus 10 Year Weather and Fuels Data


Maximum Temperature
Maximum Temperature (fahrenheit)
115
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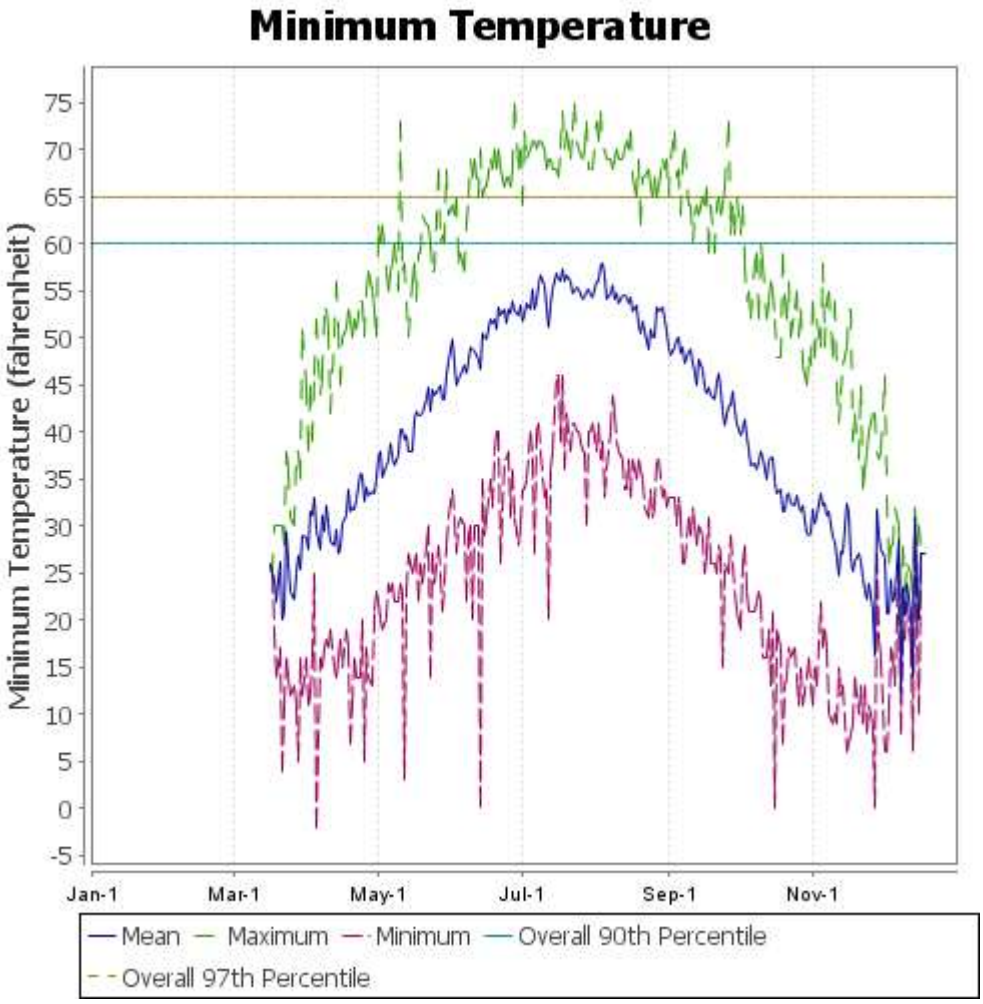
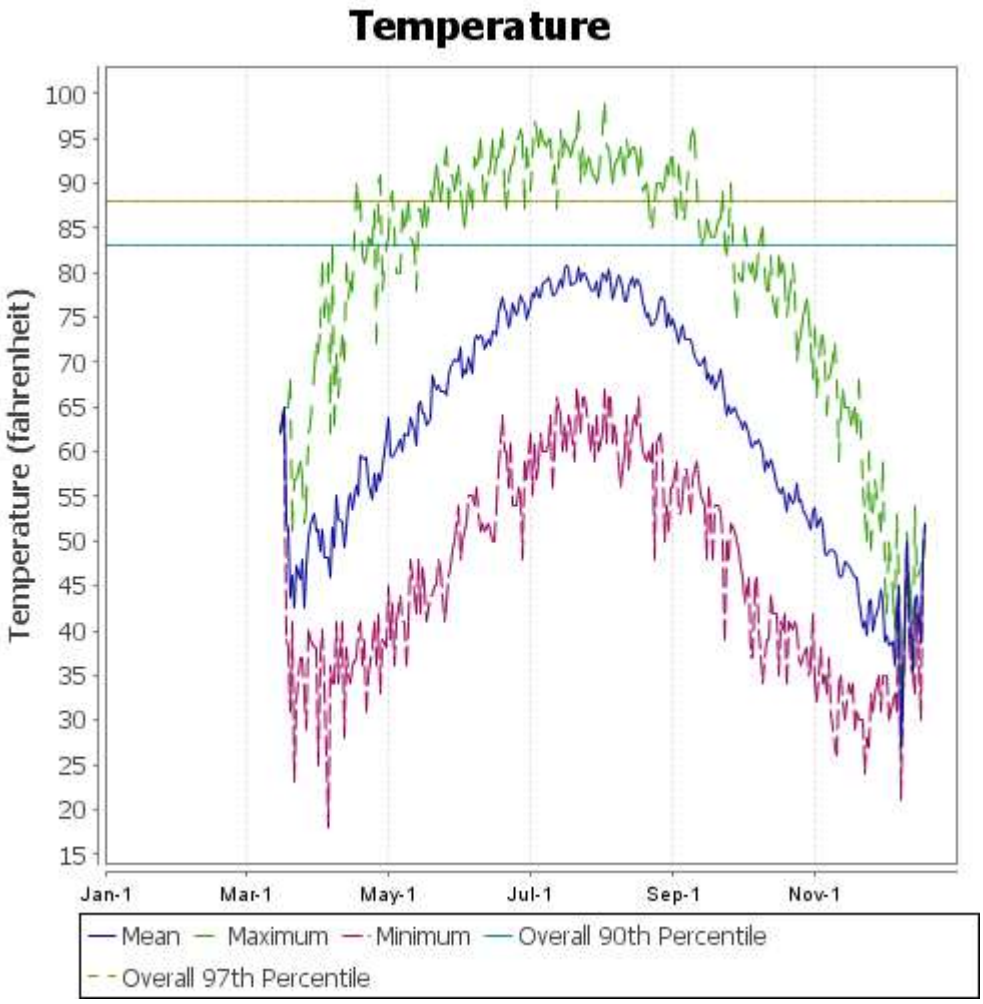
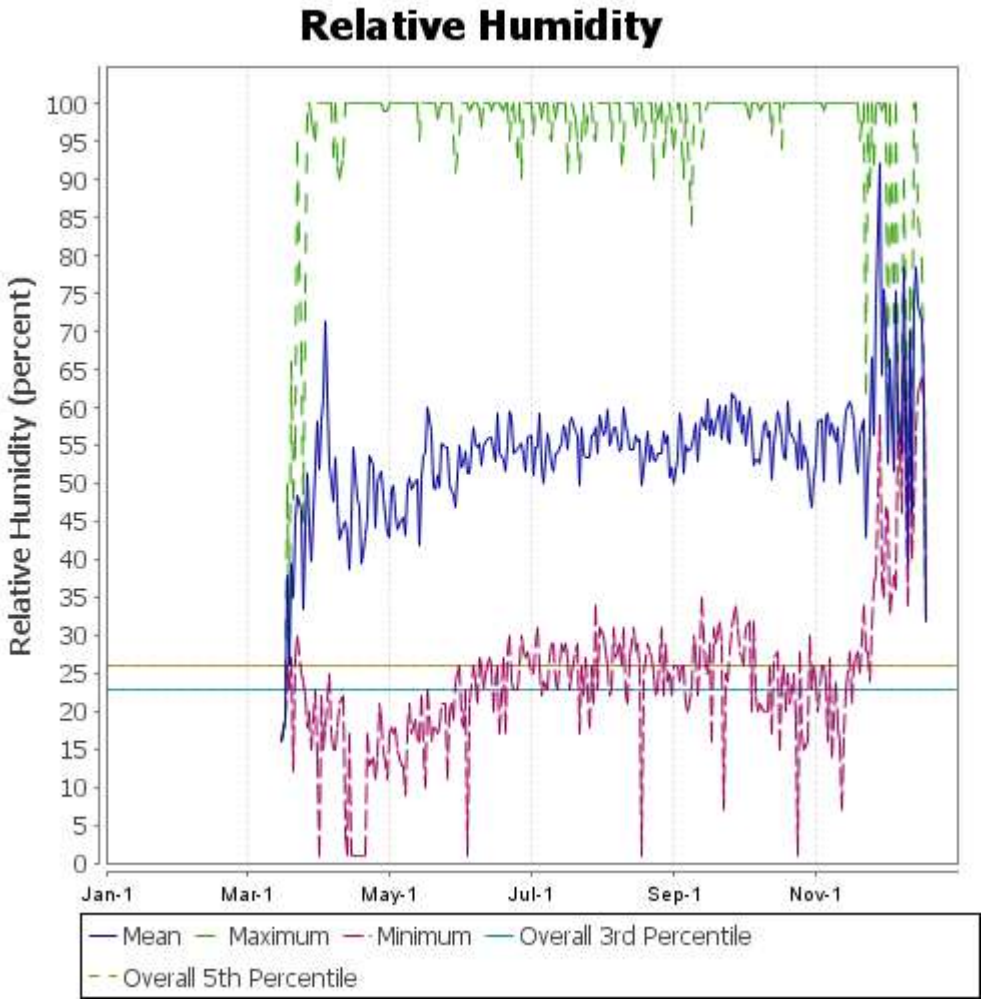
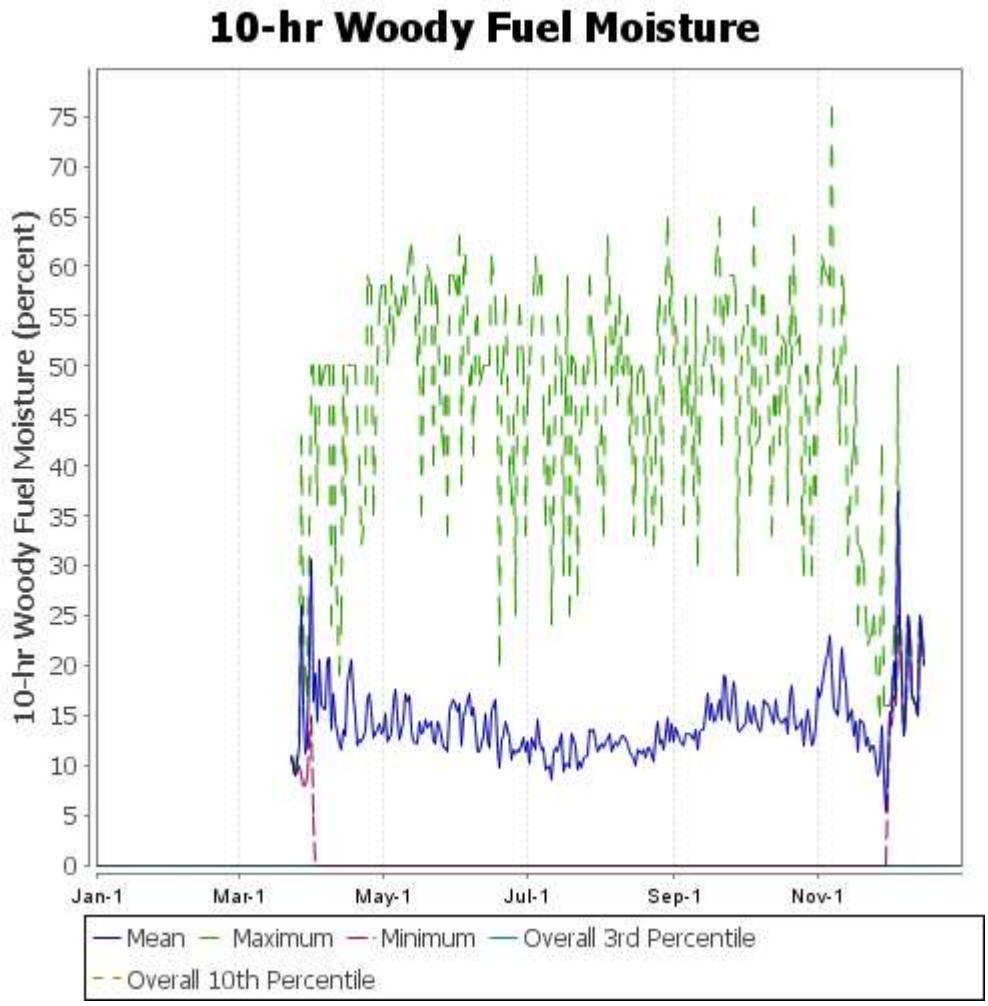
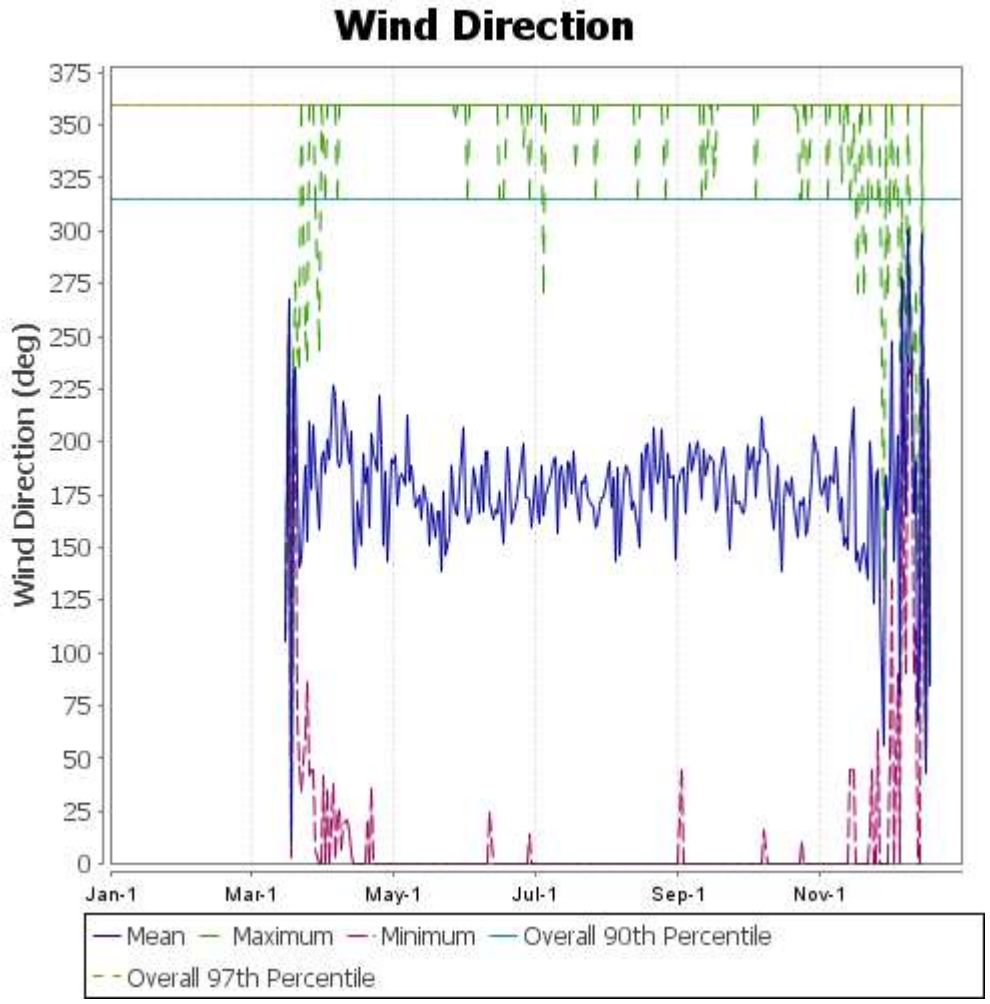
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile

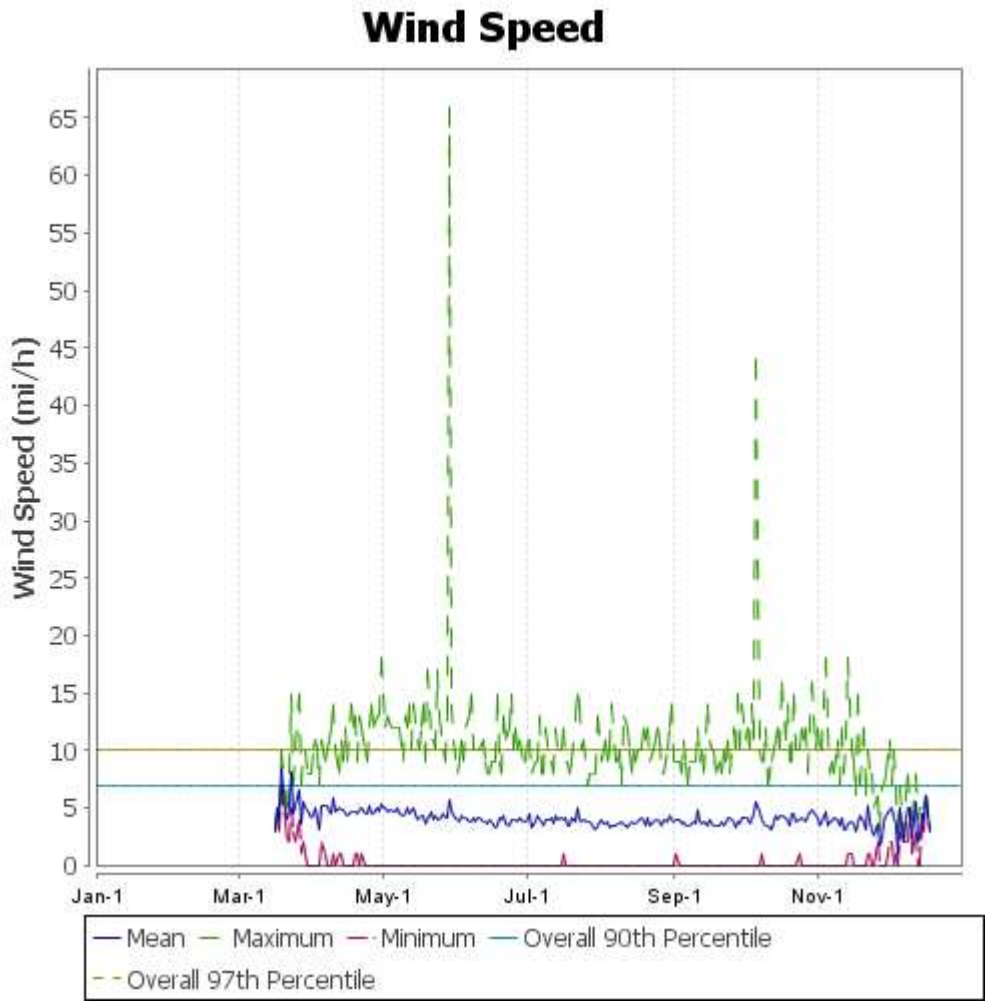

Minimum Temperature
Minimum Temperature (fahrenheit)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile

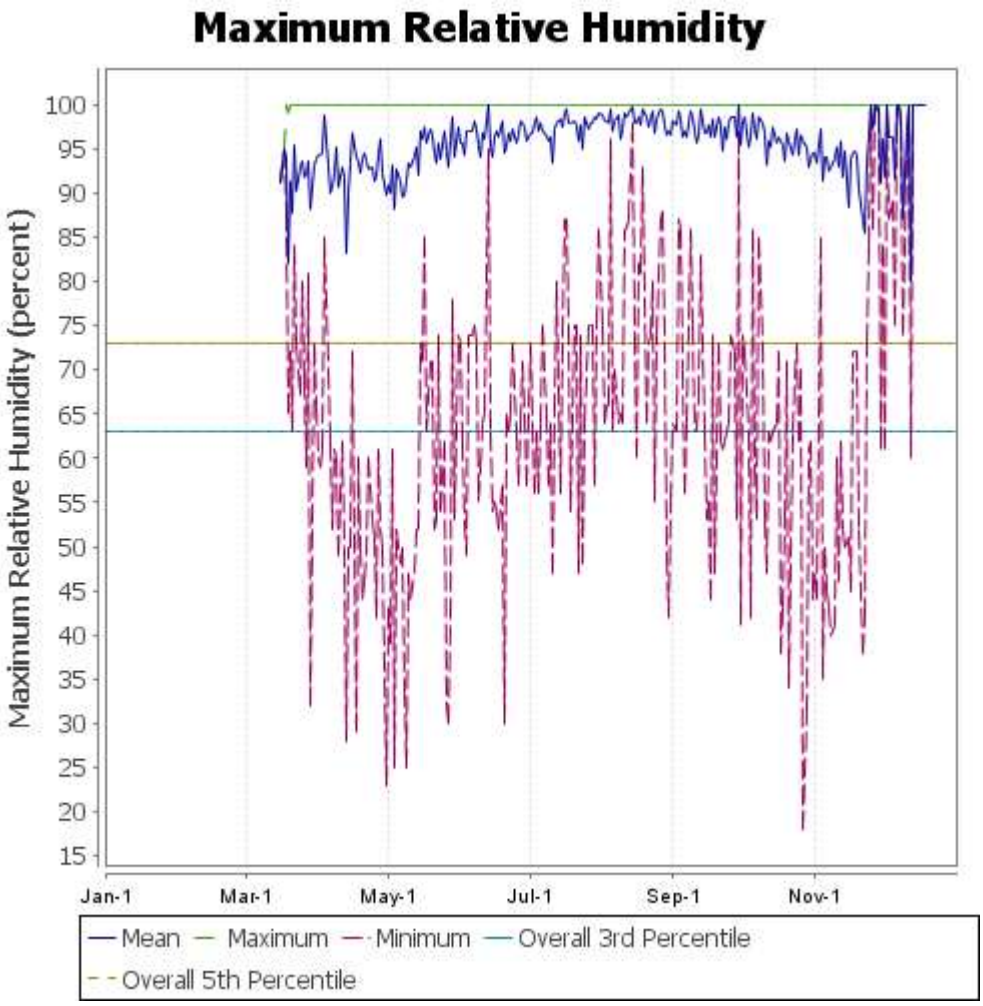

Temperature
Temperature (fahrenheit)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile

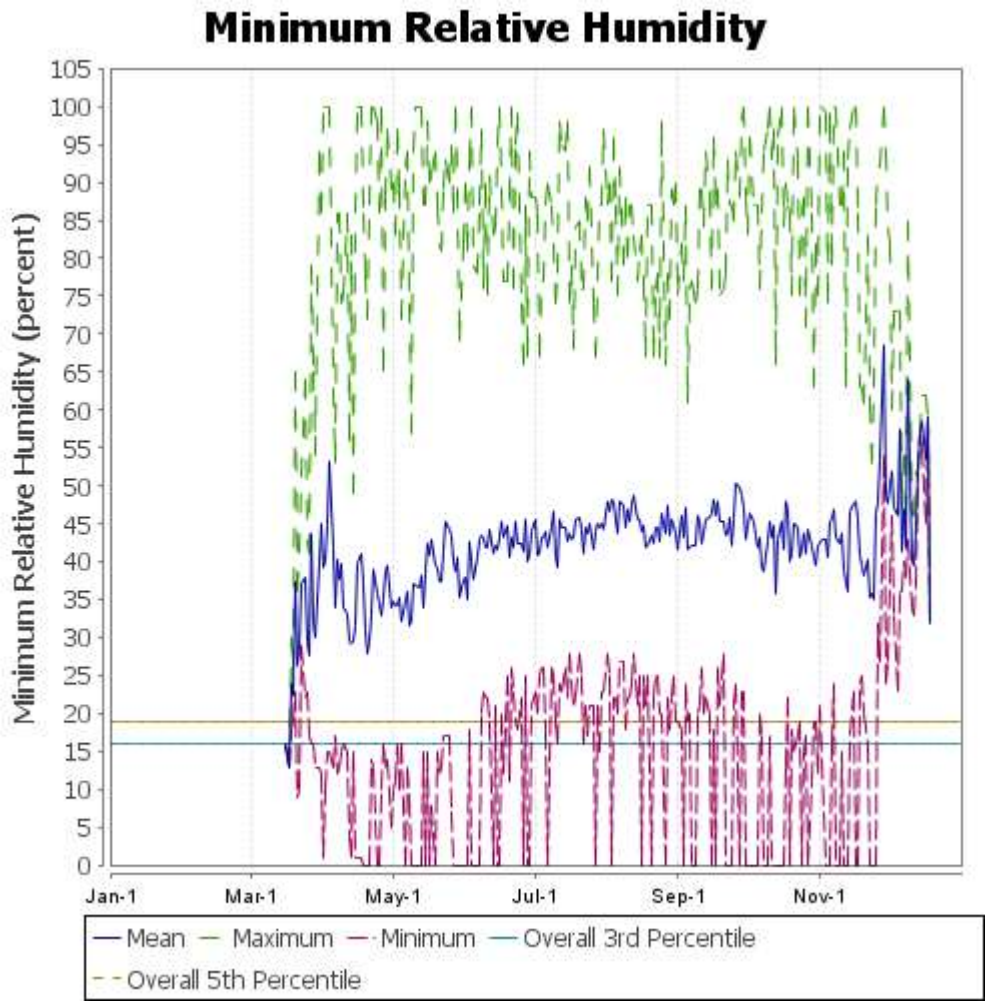

Relative Humidity
Relative Humidity (percent)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 5th Percentile

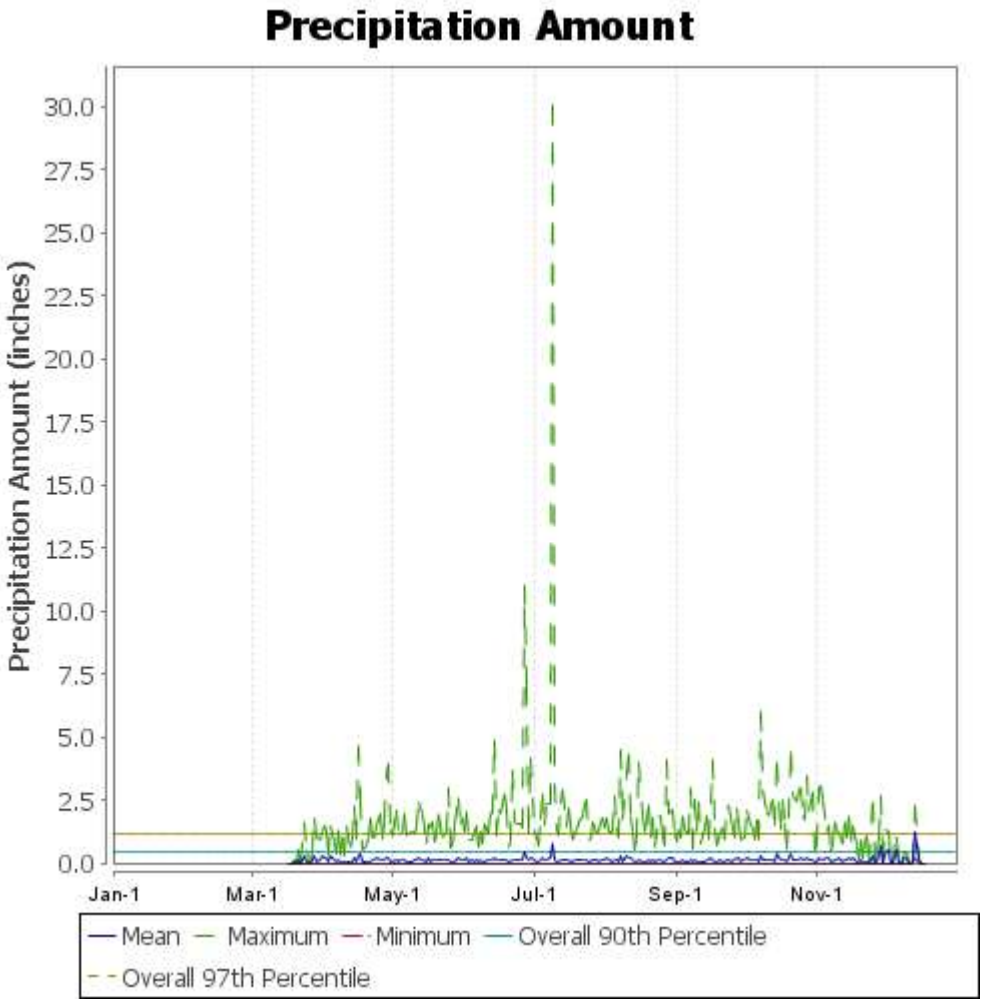

10-hr Woody Fuel Moisture
10-hr Woody Fuel Moisture (percent)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 10th Percentile

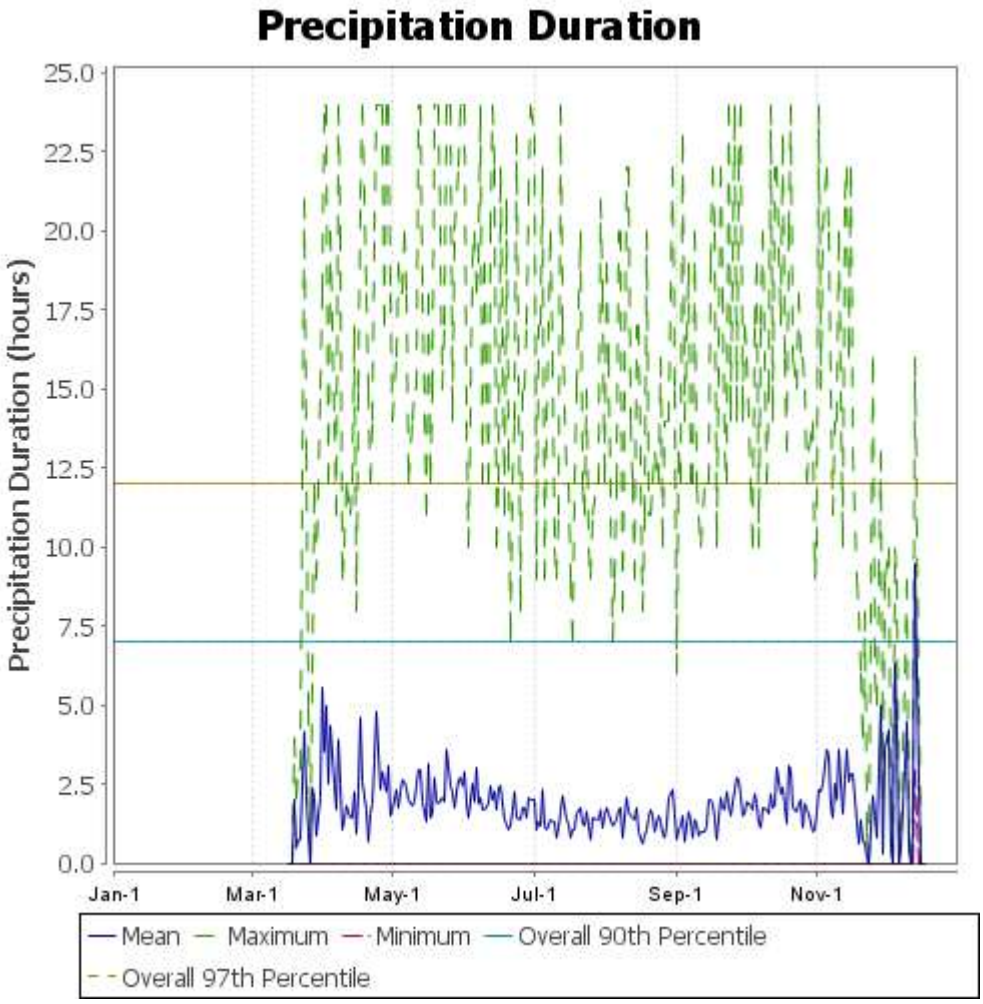

Wind Direction
Wind Direction (deg)
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile

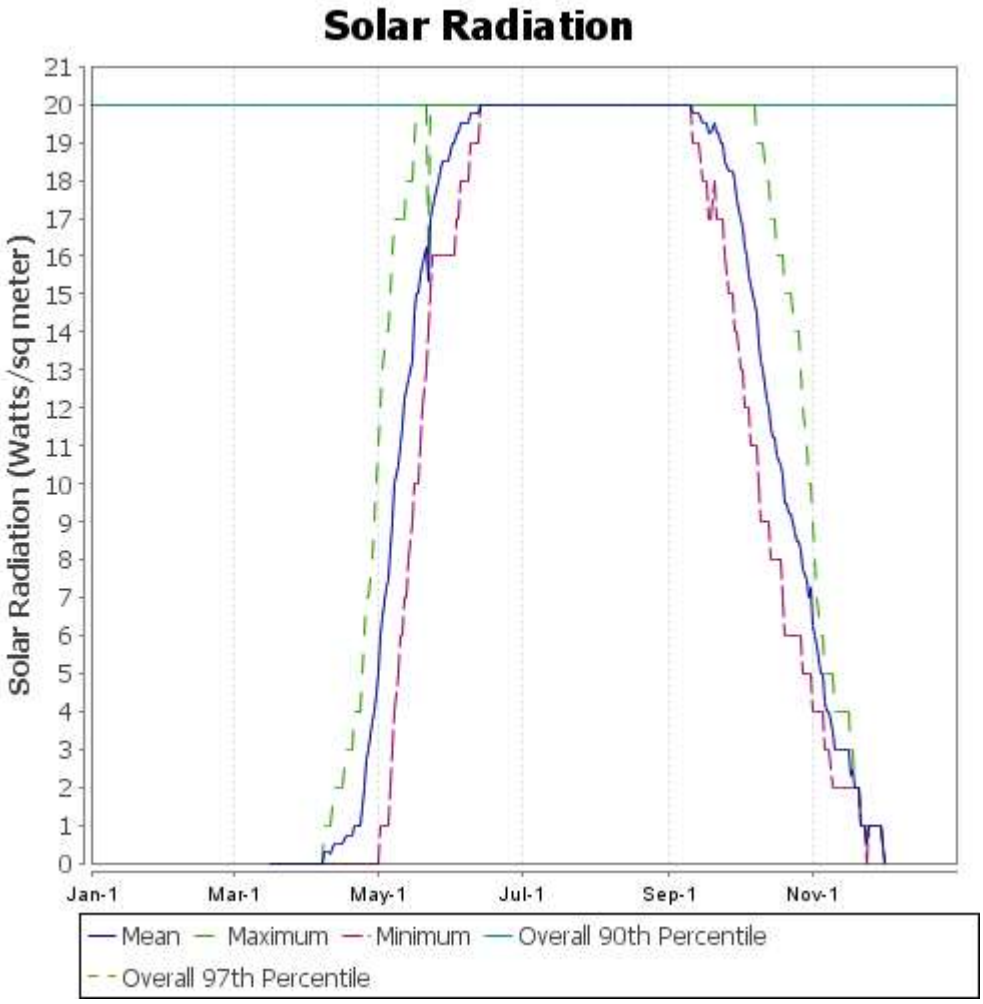

Wind Speed
Wind Speed (mi/h)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile

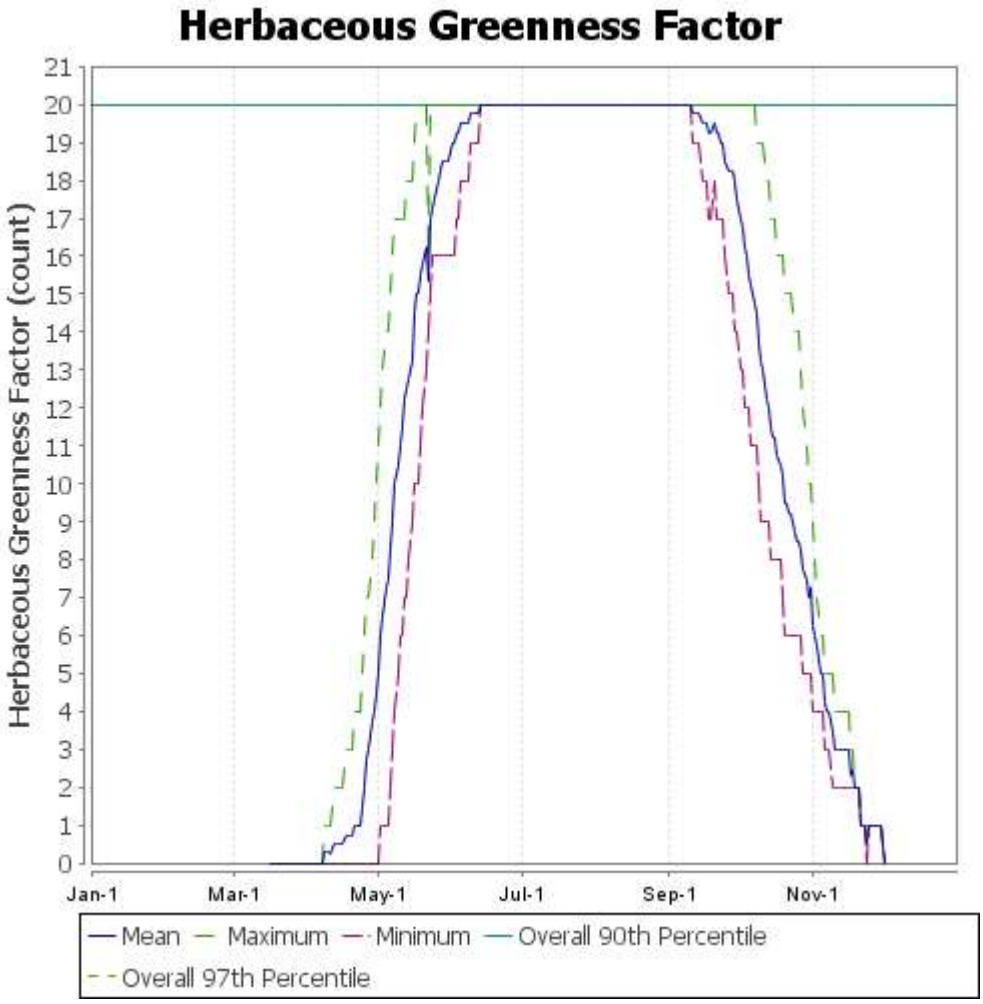

Maximum Relative Humidity
Maximum Relative Humidity (percent)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 5th Percentile

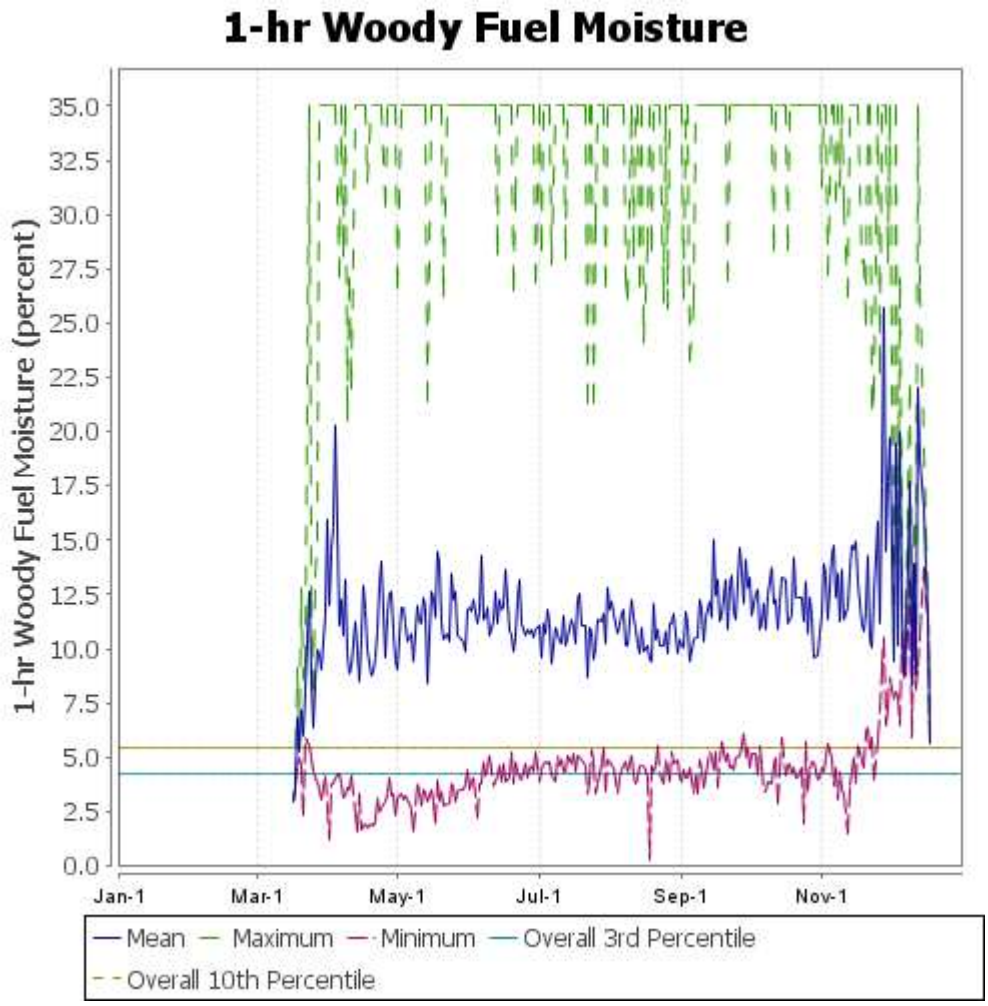

Minimum Relative Humidity
Minimum Relative Humidity (percent)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 5th Percentile

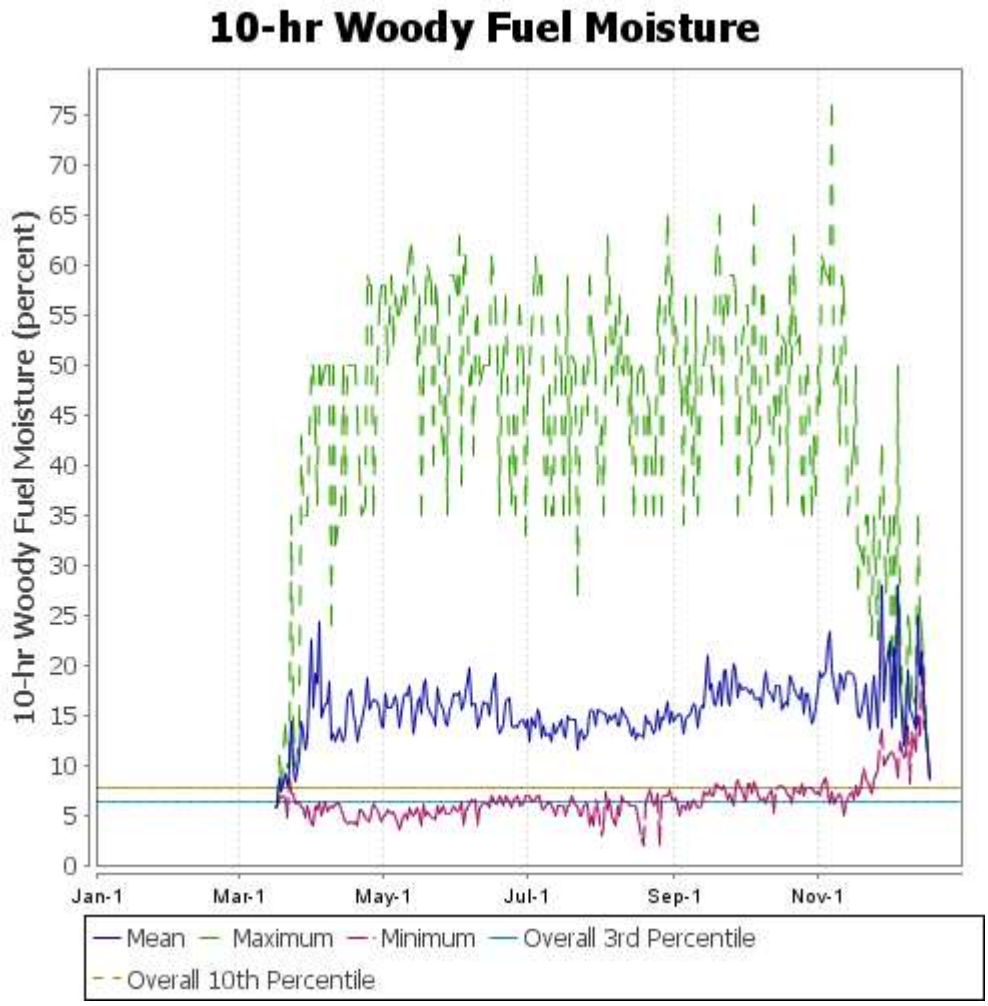

Precipitation Amount
Precipitation Amount (inches)
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile


Precipitation Duration
Precipitation Duration (hours)
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile


Solar Radiation
Solar Radiation (Watts/sq meter)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile


Herbaceous Greenness Factor
Herbaceous Greenness Factor (count)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 90th Percentile
Overall 97th Percentile


1-hr Woody Fuel Moisture
1-hr Woody Fuel Moisture (percent)
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 10th Percentile


10-hr Woody Fuel Moisture
10-hr Woody Fuel Moisture (percent)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Jan-1
Mar-1
May-1
Jul-1
Sep-1
Nov-1
Mean
Maximum
Minimum
Overall 3rd Percentile
Overall 10th Percentile

Appendix C - Interagency Agreements

Appendix D – Goals, Objectives, Strategies

Number	Goal, Objective or Strategy	Target	Responsible party
Goal 1.	**Ensure safety of all wildland firefighters and site users.**	Continuous	WFPM
Objective 1.1	Ensure all DMAVS/NHARNG wildland firefighters and Cooperators on prescribed burns are certified to National Wildfire Coordinating Group (NWCG) or New Hampshire Prescribed Fire Council (NHPFC) standards for the position they are performing.	Continuous	WFPM
Strategy	Utilize NWCG training courses provided by local, state and federal agencies. DMAVS/NHARNG will consider sponsoring courses as needed to support personnel training needs.	As available	Various Agencies
Strategy	Attend annual safety refresher including work capacity tests and fire shelter deployment exercise.	Annually	WFPM & Each Individual
Strategy	Implement personnel training plan to develop in house capabilities to conduct prescribed fires.	Annually	WFPM
Objective 1.2	Provide awareness education to all site users/personnel about wildland fire and prescribed burning.	Continuously	WFPM
Strategy	Distribute wildland fire awareness material (posters, e-tips, etc.) to site personnel.	Annually	WFPM
Strategy	All personnel involved in fire management operations on DMAVS/NHARNG land will receive a safety briefing that will include: resources of value, chain of command, fire suppression strategy, tactics and hazards, and current fuels, weather and fire behavior.	Each Burn	WFPM or Burn Boss

Number	Goal, Objective or Strategy	Target	Responsible party
Strategy	Utilize Standard Operating Procedures (SOP) for fire management activities occurring in or near the Pembroke Water Works wellhead protection area, the electric power transmission easement owned by Eversource and the natural gas line owned by National Grid.	Prior to burns adjacent to resource	WFPM/USFS
Objective1.3	Ensure all wildland firefighters are equipped with personnel protective equipment and functional firefighting equipment to do the job safely.	Prior to each burn	WFPM and Burn Boss
Strategy	Maintain a list of existing and needed firefighting equipment.	Annually	WFPM
Strategy	Inspect PPE on annual basis and replace as needed.	Continuous	Each Individual
Objective 1.4	Coordinate wildland firefighter training with other local, state and regional federal agencies.	Continuous	WFPM
Strategy	Invite local and state firefighting agencies to each site to provide site familiarization and clarify roles and responsibilities during a wildfire response or prescribed fire event and participate in emergency response drill with local FD and DMAVS/NHARNG staff.	Annually with burn plan approval/ obtaining fire permit	WFPM
Project 1.4.1	Develop and implement a wildfire response exercise with local FD and/or State FPB personnel.	2025	WFPM
Strategy	Make theDMAVS/NHARNG sites available to other agencies to conduct on the ground training exercise in accordance with this IWFMP and existing burn plans.	As requested	WFPM/NHPFC
Strategy	Include training as an objective in all burn prescriptions.	Continuous	WFPM
Strategy	Develop/utilize cooperative fire agreements with other agencies that facilitate training and execution of prescribed burns.	2021	WFPM & WMNF
Objective 1.5	Establish escape route	2023	WFPM

Number	Goal, Objective or Strategy	Target	Responsible party
Strategy	Utilize fire breaks established under objective 2.3	2023	WFPM/FMO
Project 1.5.1	Construct pedestrian and utility vehicle (UTV) bridge across stream crossing on Soucook Trail fire break	2023	WFPM/FMO
Goal 2.	**Minimize the effects of wildland fire on public health and safety.**	Continuous	WFPM
Objective 2.1	Increase public awareness of wildland fire and use of prescribed burning.	Annually	WFPM/NHPFC
Strategy	Mail burn season notifications and requests for day prior and/or day of notification forms to adjacent and other nearby land owners/occupants and smoke sensitive receptors.	Annually by February 15th	WFPM/Burn Planner
Strategy	Contact via phone or e-mail adjacent landowners and smoke sensitive receptors the day before or day of prescibed buring as specified on returned notification.	Each Burn	WFPM or Burn Boss
Strategy	Place warning signs along roads where smoke may be encountered.	Each Burn	WFPM or Burn Boss
Strategy	Contact local emergency agencies as part of Day of Burn Notification to ensure aware of fire management activities.	Each Burn	WFPM or Burn Boss
Objective 2.2	Reduce fuel loads to minimize the intensity of any wild fires through the use of prescribed fire and mechanical treatment/forestry.	2025	WFPM
Strategy	Implement prescribed burns as identified in Goal 4	2025	WFPM
Strategy	Mechanically treat hazardous fuel prior to ecological burns or where burns cannot be conducted in accordance with Goal 4.	As needed	WFPM

Number	Goal, Objective or Strategy	Target	Responsible party
Objective 2.3	Establish and maintain permanent fire breaks as control lines for wildfires and contingency lines for prescribed fires. Implement plan in **Error! Reference source not found.** for upgrade and maintenance of road system and fire breaks on ECTC to facilitate rapid response to wildfire or other emergency incidents.	2025	WFPM and Site Maintenance Staff
Project 2.3.1	Establish vegetative fuel breaks 1, 2, and 3 in the northern portion of ECTC	2021	WFPM
Project 2.3.2	Establish vegetative fuel breaks 5 and 6 in the southern portion of ECTC.	2023	WFPM
Project 2.3.3	Mechanically treat (mow) fuels along 4 miles of roads/trails edges on the ECTC to reduce road/trail side vegetative cover and increase firebreak width.	2021 & 2025	WFPM
Project 2.3.4	Mowed vegetative firebreaks at the SMR as identified in Map 9 including along all SMR fence lines.	Annually	SMR Maintenance Staff
Project 2.3.5	Evaluate the need for shaded fuel breaks along the properties boundaries in the forested portion of the NHNGTS	2021	WFPM
Project 2.3.6	Establish shaded fuel break along boundary of priority forest management unit if determined necessary	2023	WFPM
Objective 2.4	Manage smoke emissions from prescribed and wildland fire to minimize impacts on DMAVS/NHARNG properties and surrounding areas.	Continuous	WFPM

Number	Goal, Objective or Strategy	Target	Responsible party
Strategy	Collect data of meteorological and fuels information to help predict the effects of smoke from fire management activities on DMAVS/NHARNG. Use FOFEM, V-Smoke or similar smoke modeling software to estimate plume rise and direction and emissions levels. Use database to identify optimal burning conditions for specific burn unit.	Continuous during burn windows and included in unit burn plans	WFPM, Burn Planner
Strategy	Create map of smoke sensitive receptors within 1 and 5 mile radius around DMAVS/NHARNG sites or based on smoke modeling dispersion distances. Use smoke models and local knowledge to determine radius distance. Receptors should include hospitals, nursing homes, schools, towns, highways, and airports. This map should be updated annually.	Annually update included in unit burn plan	WFPM. Burn Planner
Strategy	During prescribed burns use avoidance, dispersion/dilution, and emission reduction techniques to reduce emission levels.	Continuous	Burn Boss
Strategy	Develop partnerships with federal, state and local agencies to assess and monitor potential impacts of smoke from prescribed and wildland fires on DMAVS/NHARNG. Cooperators may include groups such as the US Fish and Wildlife Service, NH Fish and Game, US Forest Service, The Nature Conservancy, NH Department of Environmental Services and local fire depts.	Continuous	WFPM
Strategy	Conduct prescribed burns only on days when smoke intrusions into smoke sensitive areas is highly unlikely, i.e., burn on days when the winds will carry smoke away from smoke sensitive areas.	Each Burn	WFPM/Burn Planner

Number	Goal, Objective or Strategy	Target	Responsible party
Strategy	Burn during periods of good vertical dispersion or burn at slower rates in order to dilute smoke through greater volumes of air.	Each Burn	WFPM/Burn Planner
Strategy	Burn units on the SMR should not be larger than 0.8 acres to minimize smoke impacts to surrounding area. Burn units on the ECTCshould not be more than 5.5 acres to minimize smoke impacts to surrounding areas.	Each Burn	WFPM/Burn Planner
Strategy	Use effective firing techniques and the proper scheduling of burns to minimize smoke and reduce emission output per unit area burned.	Each Burn	Burn Boss
Goal 3	**Minimize effects of wildland fire on resources of value (cultural resources, T&E species, utilities, ground and surface waters).**	Continuous	WFPM
Objective 3.1	Conduct archaeological surveys on all ECTC fire management units and receive SHPO concurrence for planned activities prior to implementation.	2020	CRM
Project 3.1.1	Conduct archaeological survey on management unit DAOF 8.	2019 (Completed)	CRM
Objective 3. 2	Minimize impacts to T&E species from prescribed fire and other fire management activities.	Continuous	NRM/WFPM
Strategy	DMAVS/NHARNG will update information on rare flora and fauna within fire management units through planning level surveys and monitoring identified in the INRMP	Annually	NRM
Strategy	Utilize protection strategies identified in Tables 4, 5 and 6.	Continuous	WFPM
Strategy	DMAVS/NHARNG will conduct a pre and post survey through burn units a minimum of 1 week before and after burning to identify any rare species within the unit. Adjust timeframe depending on species at risk.	Each burn	NRM

Number	Goal, Objective or Strategy	Target	Responsible party
Strategy	DMAVS/NHARNG will brief prescribed burn crew on day of burn regarding existence of and protection measures for T&E species within the burn units.	Each burn	Burn Boss
Objective 3.3	Use best available information and technology to prevent contaminates from entering ground or surface water.	Continuous	WFPM/Burn Boss
Strategy	Utilize Standard Operating Procedure for Operation in Pembroke Wellhead Protection area identified in Section 5.6.	Each Burn	WFPM/Burn Boss
Strategy	Continue to investigate and test alternative drip torch fuels.	Each burn on ECTC	WFPM/Burn Boss
Goal 4	**Manage Fire Dependent and Fire Adapted Natural Communities using prescibed fire as a primary mechanism for ecosystem management and mechanical treatment as a secondary mechanisim, to support INRMP implementation, reduce risk of wildfire and, support mission capabilities.**	Continuous	WFPM/NRM
Objective 4.1	ECTC: Use prescribed fire on 5 of the 12 PPSOW (units 5, 7, 8, 12) units at least once over the next 5 years.	2025	WFPM
Project 4.1.1	Conduct a prescibed burn on management units PPSOW 7 & 8.	2021	WFPM
Project 4.1.2	Conduct prescribed burn on management units PPSOW 1, 5 and 12.	2022	WFPM
Project 4.1.3	Conduct a second prescribed burn on 3 PPSOW management units (TBD).	2023-2025	WFPM
Objective 4.2	SMR: Use prescribed fire on 10 of 23 management units over the next 5 years.	2025	WFPM
Project 4.2.1	Conduct a prescibed burn on 2 management units.	2021	WFPM
Project 4.2.2	Conduct a prescibed burn on 2 management units.	2022	WFPM

Number	Goal, Objective or Strategy	Target	Responsible party
Project 4.2.3	Conduct a prescibed burn on 2 management units.	2023	WFPM
Project 4.2.4	Conduct a prescibed burn on 2 management units.	2024	WFPM
Project 4.2.5	Conduct a prescibed burn on 2 management units.	2025	WFPM
Objective 4.3	ECTC: Use prescribed fire on 3 of 21 DAOF unit during the next 5 years.	2025	WFPM
Project 4.3.1	Pembroke: Conduct prescibed burns on 1 of 7 DAOF management units (DAOF 1, 2, 3, 4, 5, 11, 12).	2022	WFPM
Project 4.3.2	Pembroke: Conduct prescibed burns on 1 of 7 DAOF management units (DAOF 1, 2, 3, 4, 5, 11, 12).	2023	WFPM
Project 4.3.3	Pembroke: Conduct prescibed burns on 1 of 7 DAOF management units (DAOF 1, 2, 3, 4, 5, 11, 12).	2025	WFPM
Goal 5	Mechanically treat (brontosaurus mowing) and/or conduct forestry operations to reduce fuels prior to ecological burns and when burn units are not capable of being burned within a specific burn rotation window.	2025	WFPM
Objective 5.1	Prepare 3 additional PPSOW management units (PPSOW 1, 2, 6) for prescribed burns in years subsequent to this planning period (2026-2030).	2024-2025	WFPM
Project 5.1.1	Conduct mechanical treatment (brontosaurus mowing) and/or whole tree harvesting on 3 PPSOW management unit.	2024-2025	WFPM
Project 5.1.2	Establish Temporary fire breaks/mowlines in 3 PPSOW management units	2024-2025	WFPM
Goal 6	Maintain NHNGTS grassland to support INRMP Implementations (Minimize woody vegetation and maintain open training space)	2025	WFPM
Objective 6.1	Conduct prescribe burn across all available NHNGTS grasslands	2025	WFPM

Number	Goal, Objective or Strategy	Target	Responsible party
Project 6.1.1	Conduct Prescribed burn in Grassland Unit 2	2021	WFPM
Project 6.1.2	Conduct Prescribed burn in Grassland Unit 4	2022	WFPM
Project 6.1.3	Conduct Prescribed burn in Grassland Unit 3	2023	WFPM
Project 6.1.4	Conduct Prescribed burn in Grassland Unit 1	2024	WFPM
Project 6.1.5	Conduct Prescribed burn in Grassland Unit 2	2025	WFPM

Appendix E – Fire Breaks

Table 15 SMR Road Maintenance/firebreak

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Greely Street	Forms eastern boundary of the SMR.	1050 ft	Primary fire break between SMR and residential area east of the SMR and CMA conservation area	Good	The street is maintained by the City of Concord.
Pembroke Road	Forms northern boundary of the SMR	1600 ft	Primary fire break between SMR and residential and commercial areas north of the SMR	Good	Maintained by the City of Concord.
Regional Drive	Forms a portion of the Southern Boundary of the SMR	450 ft	Primary fire break between the SMR and the CMA	Good	Maintained by the City of Concord.
Airport Road	Forms Western boundary of the SMR	1700 ft	Primary fire break between SMR and residential and commercial areas west of th SMR	Good	Maintained by the City of Concord.

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Minuteman Way	Primary Access road to the SMR for Regional Drive	995 ft	Non-burnable fire break between eastern and western portion of the SMR	Good	Maintained by CFMO
Gravel Road	Between USPFO parking lot and KBB building	460 ft	Access to KBB captive rearing building and non-burnable fire break between management units	Fair	Maintained by CFMO, regrade as needed to ensure access.
Firebreak 1: Eastern fence line	From walkway in fromt of USPFO to Minuteman Way Guard Shack	1775 ft	Stone dust walking/running path between fire management units and eastern fence line. Mow adjacent to path.	Good alone most of its length.	High – mow at minumum 1 time per year as often as weekly to maintain 10 ft. fence line force protection clearence.
Firebreak 2: South-Western fence line	From Minuteman Way guard shack to JFHQ parking lot	1357 ft	Mowed firebreak between fire management units and fence line.	Good along southern section. Overgrown along military vehicle (MOV) parking lot fence.	High- clear along MOV parking lot. Mow at minimum 1 time per year as often as weekly to maintain 10 ft fence line force protection clearence.

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Firebreak 3: JFHQ-SCIF	From JFHQ cul-de-sac to Building M Parking lot	251 ft	Firebreak between management unit W7 and JFHQ and SCIF.	Fair. Consider expaning mowed firebreak around SCIF fence to 20 feet.	High - mow on a weekly basis.
Firebreak 4: Communication Line	Between USPFO Parking Lot and KBB Building	310 feet	Firebreak to minimize potential damage to overhead communication line.	Poor. Tree and shub removal needed.	High - mow at 1 time per year after September 1st or prior to April 15th.

Table 16 ECTC Maintenance/Firebreak Activities

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Riverwood Improved Gravel/dirt road	From Riverside Dr. cul-de-sac west edge of utility right-of-way.	1180 ft	Alternate access to north section of ECTC. Will need to be navigable by fire and emergency vehicles for suppression and prescribed burning.	Good to Fair- Eastern portion are partially overgrown and need maintenance. Gate needed for access.	Medium- Secondary access to PPSOW and DAOF Burn Units planned in 2021-2025 and secondary contingency line for wildfires.
Riverwood Trail	West side of utility right-of-way to Junction with Soucook trail.	732 ft	Primary access to north section of ECTC. Will need to be navigable by fire and emergency vehicles for suppression and prescribed burning. Firebreak/Control line for 9 burn units	Good to Fair- Western portion of the trail were improved following forestry operation during the winter of 2016-2017. Eastern portion improved fall of 2019 during transport for mechanical treatment in PPSOW5.	Medium- Secondary access to PPSOW and DAOF Burn Units planned in 2021-2025 and secondary contingency line for wildfires.
Soucook North Trail	From west end of Riverwood Trail to Soucook River	606 ft	Access to draft sites along Soucook River. Firebreak/Control line for 4 burn units.	good - Trail was improved following forestry operation during the winter of 2016-2017 and during prep of PPSOW10-12 in 2018 & 2019.	Medium - Provides access to water and is control line for PPSOW burn unit Planned for 2021-2015.

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Floodplain Trail	From north end of Soucook Trail to end of pennsula.	2177 ft	Primary access to northwest portion of ECTC and draft site on soucook river. Should at least be accessible for UTV patrols.	Fair. Overgrown. Will need mowing/mechanical treatment along edges to draft site.	Low- Only 1 Burn Units planned outside 5 Year window.
Soucook Trail	From Junction with Riverwood trail to junction with South access trail	2149 ft	Alternative access and escape route between northern and southern portions of the property	Good. Mowing conducted along edge of trail in fall of 2015	Low – maintain once every five years.
Soucook South Trail	South from Junction of Riverwood and Soucook Trail.	723 ft	Main access to Soucook River and firebreaks for 4 management units.	Fair – Overgrown and some erosion. Will need mowing/mechanical treatment along edges and erosion control.	Low- provides access to burn units planned beyond the plan period.
Firebreak 1	From Class 6 portion of Riverwood Drive north along west side of powerline to Soucook River	1103 ft	Firebreak along powerline corridor. Control line for 3 burn units.	Good. Cut in 2018 by Liberty Utilities.	High - Provides firebreak along portion of powerline and is control line for high priority PPSOW burn unit 5.

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Firebreak 2	From Riverwood Trail north along NHARNG/private boundary	1003 ft	Firebreak along ECTC boundary near PPSOW fuels. Control line for 3 burn units.	None existent. Will need to construct and maintain.	High- Provides firebreak along NHARNG/private boundary. High priority burn unit and escape route.
Firebreak 3	From Riverwood Trail north along NHARNG/private boundary west of Firebreak 2.	897 ft	Firebreak along ECTC boundary near PPSOW fuels. Control line for 2 burn units.	Fair. 2016 & 2017 firebreak constructed & maintained for prescribed burning in PPSOW3 and 4. Maintenance will be required during plan period.	High - maintainance of firebreak along private property.
Firebreak 4	From firebreak 3 to Junction of Soucook North and flood plain trail	875 ft	Fuel break and water point access from primary PPSOW burn units 1, 2, 3 & 4	Fair 2016 & 2017 firebreak constructed & maintained for prescribed burning in PPSOW3 and 4. Maintenance will be required during plan period.	High – primary access to water point access on soucook river
RC Perimeter Trail	Around Perimeter of Planned Pembroke Readiness Center	2763 ft	Primary protection for Readiness Center	Good. Gravel surface. Constructed in 2019-2020 with RC.	High

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
South Access Trail	From planned Pembroke RC to Junction of Soucook trail and South Soucook trail	207 ft	Connection from Readiness Center to Soucook and South Soucook trails	Poor. Steep and highly eroded. Alternate location should be investigated.	Moderate – No burn units planned but provides alternate escape route from soucook trail.
North Access Trail	From ECTC access gate on Riverwood Drive to class 6 portion of Riverwood Drive	1069 ft	Provides primary access to northern portion of ECTC and burn units planned for 2021-2025. Primary contingency line.	Good. Trail was improved following forestry operation during the winter of 2016-2017.	High – maintain as needed
Firebreak 5	Southern boundary of ECTC	1455 ft	Primary fuel break protecting adjacent properties and our property from wildfire offsite to south.	Non-existent.	Low – RC protected by RC perimeter trail and other paved surfaced. No RX burns planned in plan period.
Firebreak 6	From Readiness Center access road to Firebreak 5	935 ft	Primary Access to Firebreak 5 and achor point to Readiness Center Road	Poor. Overgrown logging trail.	Low - RC Protected by RC perimeter trail and other paved surfaced. No RX burns planned in plan period.

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
Firebreak 7	Along western side of utility right-of-way from southern boundary of the property to class 6 portion of Riverwood Drive	2623 ft	Primary firebreak protecting utilities. contingency line for burns.	Fair. Dirt & grass trail along most of the length	Medium – Should be maintained on annual basis as needed.

Table 17 NHNGTS Road Maintenance/Firebreaks

NAME	LOCATION	LENGTH	SIGNIFICANCE	CONDITION	5 YEAR PRIORITY
East Range Road	East side of open grasslands	1236 ft	Primary fire break to grassland Management units	Good	Maintained by NHNGTS
West Range Road	West side of open grasslands	1210 ft	Primary fire break to grassland Management units	Good	Maintained by NHNGTS
Range Road 1	Southern most east-west Range Road in open grasslands	806 ft	Primary fire break to grassland Management units	Good	Maintained by NHNGTS
Range Road 2	Middle east-west Range Road in open grasslands	756 ft	Primary fire break to grassland Management units	Good	Maintained by NHNGTS
Range Road 3	Northern most east-west Range Road in open grasslands	744 ft	Primary fire break to grassland Management units	Good	Maintained by NHNGTS
Range Road	From open Grasslands to Johnsonboro Road at north end of property	3745 ft	Primary fire break in forested portion of the property	Good	Maintained by NHNGTS
Johnsonboro Road	Forms northern boundary of the property	850 ft	Primary firebreak north of the property. Secondary access for Control	Fair	Class 6 Non-maintained town road

Appendix F - NHARNG Monitoring Worksheet

Pre Burn Fire Weather and Fuel Observation Sheet (NWS Concord Airport Weather Station, Daily Climate Report) and (Bear Brook State Park RAWS)

http://www.nws.noaa.gov/climate/

Date	Weather	Air Temp (F)		Humidity (%)		Wind Speed (daily avg. mph)	Wind direction	Precipitation (inches)	Fine Dead Fuel Moisture	10 Hour Fuel Moisture	Live Fuel Moisture
	MesoWest Conditions for KCON Concord Municipal Airport http://mesowest.utah.edu/cgi-bin/droman/meso_base_dyn.cgi?stn=KCON	Min	Max	Min	Max				WIMS@ BBSP https://nap.nwcg.gov/NAP/#	WIMS	WIMS WDY/HRB

Pre Burn Fire Weather and Fuel Observation Sheet

On-Site Collection

Date	Time	Location (Unit #)	Shaded or Unshaded	Weather (sky)	Dry Bulb Temp	Wet Bulb Temp	Humidity (%)	Fine Dead Fuel Moisture	POI	Wind Speed AVG.	Wind Speed MAX	Wind Direction	10 Hour Fuel Moisture

Day of Burn Weather and Fire Behavior Observation Sheet

Date:_____ Weather Observer/FEMO :_____ Unit:_____

Time	Type	Location	Temp		RH	Wind			FDFM	POI	Flame Length	Rate of Spread	% Consumption	Smoke
			Dry	Wet		Max	Avg.	Dir.						
0900	*Sling*	*Unit W4*	*62*	*56*	*68*	*5*	*2*	*NW*	*11*	*30*				

POST BURN SEVERITY

UNIT:		**DATE BURNED:**	
ACRES BURNED:		**AVERAGE SCORCH HEIGHT (FEET):**	

PERCENT BURN SEVERITY [1]

STRATA	UNBURNED	SCORCHED	LOW SEVERITY	MOD. SEVERITY	HIGH SEVERITY
DUFF / LITTER [2]					
SLASH & 10 HOUR FUELS					
HERBACEOUS VEGETATION					
< 1 METER					
1 to 3 METERS [3]					
> 3 METERS [3]					

[1] Enter percentages in terms of current, visible evidence across the entire unit. Do NOT attempt to estimate in relation to "what was here before the burn". The percentages for a given strata must be less than or equal to 100%. Different strata may overlap.

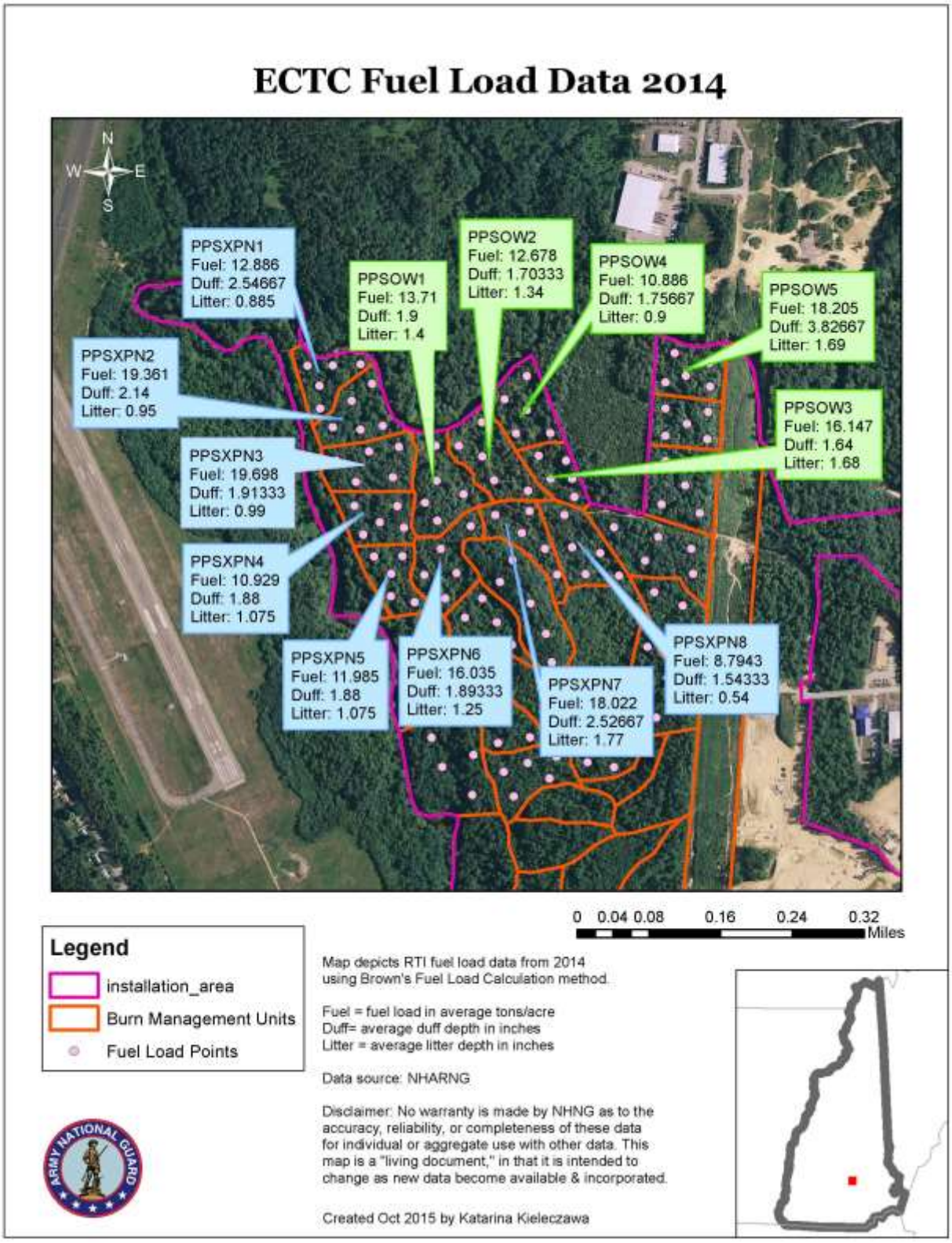
[2] Do not count litter that has fallen after, or as a result of the fire

[3] Estimate percentage based on the spread of the canopy area, not the density of the canopy.

GUIDANCE

STRATA	UNBURNED	SCORCHED	LOW SEVERITY	MOD. SEVERITY	HIGH SEVERITY
DUFF / LITTER	• Unburned	• Duff nearly un-changed • Litter partially blackened • Wood / leaf structures unchanged	• Upper duff layer burned • Litter charred to partially consumed • Wood / leaf structures charred, but recognizable	• Duff deeply burned • Litter mostly to entirely consumed • Wood / leaf structures unrecognizable	• Mineral soil visibly altered • Litter and duff consumed, leaving fine white ash
SLASH & 10 HOUR FUELS	• Unburned	• Slash foliage blackened • 10 hr. fuels blackened • Supporting stems still attached	• Some evidence of charring • Some slash foliage consumed • smaller twigs partially to completely consumed	• Charring evidence on most 10 hr. fuel • Slash foliage completely consumed	• 10 hr. fuels mostly consumed. • Smallest twigs and branches consumed.
HERBACEOUS VEGETATION	• Unburned	• Foliage dead and / or blackened • Tussocks intact • Supporting stems attached	• Some foliage and stems consumed with intact stems lying on burned areas • Tussocks intact	• Foliage and stems consumed • Only tussocks intact	• Foliage and stems consumed • Tussocks scorched or burned
WOODY VEGETATION	• Unburned	• Foliage dead or blackened • Supporting twigs still attached	• Foliage & smaller twigs partially to completely consumed	• Foliage, twigs, and small stems consumed	• All plant parts consumed leaving some or no major stems / trunks

Appendix G - ECTC Fuels Data



Appendix H – Equipment Inventory and Needs

Equipment located at SMR Building D Bay A, or Building F Office as noted

Equipment	On Hand	Additional Needed
Prescribed Burn Signs	8	
Drip torches	2	3
5 Gallon Gas Cans	1	1
6 Gallon Drum for Biodiesel	1	
6 Gallon Drum for Ethanol/E85	1	
5 Gallon diesel container	0	1
Portable containment units	3	2
Backpack pumps	2	2
Wick 100 Water Pump	1	1
Wick 250 Water Pump	1	
1200 Gallon Port-a-tank	1	1
Nozzles (	9	3
100' 3/4” hose garden hose thread	6	
100' 1" NPSH Hose	10	2
100' 1-1/2" NPSH Hose	18	
1-1/2” NPSH WYE adapters	10	
1” NPSH WYE adapters	6	
1 ½” to 1” reducer	6	
10' 1- 1/2" suction hose	3	
1-1/2’ foot valve	1	
10’ 2” Suction hose	2	
2” Foot Valve	1	
Council rakes	4	
Collapsible rakes	2	
Grass Flappers	2	
Mcleod	1	
Fire Fighter PPE including shelter (BLDG F)	4	2 replacements
Flammable Storage Cabinet	1	1
Ken Wood Radios (BLDG F)	4	
Belt weather kit (BLDG F)	1	
Kestrel Weather device		1

Equipment located at SMR Building Storage Shed near Building ST01 (owned by Fish and Game)

Equipment	**On Hand**	
Prescribed Burn Signs	2	
Drip Torches	2	
5 Gallon Gas Cans	2	
5 Gallon Diesel cans	2	
Backpack Pumps	9	
Honda WX10 Water Pump ¾’	1	
Nozzles	4	
100' 3/4” hose	7	
100' 1" NPSH Hose	4	
NPSH WYE adapters	1	
1"-3/4" reducer	1	
10' 2" Suction hose	1	
10' 1" Suction hose	1	
Stihl Brush cutter	1	
Pulaski tools	3	
Fire Fighter PPE and Fire Shelters.	4	
Flammable Storage cabinet	1	